NASA-CR-200769

Eastern Kentucky University

Department of Physics and Astronomy

Study of Activation of Metal Samples from LDEF-1 and Spacelab-2

February 1, 1996

Final Technical Report

NASA Contract # H-13013D

Principal Investigator: Dr. C. E. Laird

Prepared for

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

Eastern Kentucky University
Richmond, Kentucky 40475

Study of Activation of Metal Samples from LDEF-1 and Spacelab-2

NASA Contract # H-13013D

February 1, 1996

by

Dr. C. E. Laird
Foundation Professor of Physics
Eastern Kentucky University

Gamma-ray spectra obtained from samples flown aboard the Long Duration Exposure Facility (LDEF-1) have been analyzed to obtain the nuclear species produced in this material by the interaction of this material with protons and neutrons encountered in its 69 month orbital flight as well as to quantify the specific activity (pCi/kg) of these nuclear species. Corrections have been made for efficiency, self-attenuation, and background. The results of the spectral analysis have been tabulated and compared to those of other counting laboratories. The spectra from the counting laboratories along with viewing and analysis programs have been submitted to Marshall Space Flight Center for archiving. The form of these data and programs makes it readily accessible to the scientific, engineering and technical communities engaged in space research and application.

CONTENTS

	page
COVER PAGE	i
ABSTRACT	ii
CONTENTS	iii
LIST OF FIGURES	iv
LIST OF TABLES	v
INTRODUCTION	1
LDEF-1 Sample and Data Archival	3
Gamma-Ray Spectra Analyses	7
LDEF Activation Results from Spectral Analyses	11
LDEF Gamma-Ray Data Archive	16
REFERENCES	19
Figures	20
Tables	27
Appendix A. Efficiency and Self-Attenuation Corrections for LDEF Material	37
Appendix B. Results of Analysis of Trunnion Material	40
Appendix C. Results of Analysis of Intentional Samples	99
Appendix D. Results of Analysis of Aluminum Material	135

LIST OF FIGURES

1. Efficiency from TVA 14 Calibration 20

2. Efficiency and Attenuation for Stainless Steel Squares 21

3. Efficiency and Attenuation for Aluminum 23

4. Efficiency and Attenuation for Cylindrical Stainless Steel Absorbers 25

LIST OF TABLES

I. Trunnion Layer Specific Activities 27

II. Trunnion Section Specific Activities 29

III. Activity of Isolation-Plate Material 30

IV. Specific Activity of Clamp Plates 31

V. Summary of LDEF Activation from MSFC Measurements 32

VI. Summary of Sample Activation Results 33

VII. Background Gamma Rays from Spectrum 172 34

VIII. Background Gamma Rays from Spectrum 175 35

IX. Radioactive Decay Data Used in Data Reduction 36

Final Technical Report

NASA Contract H-13013D

Introduction

In April, 1984, the National Aeronautical and Space Administration launched the Long Duration Exposure Facility (LDEF-1) to study the environment of space and to measure the long-term effects of the exposure of spacecraft materials to the environment in low-Earth orbit. The expected orbital duration was to be 12 months at an altitude of 258 nautical miles (nm) with a 28.5° inclination of its circular orbit to the equator. Because of several delays, including the suspension of shuttle flights following the explosion of the shuttle Challenger, the facility was not retrieved until January 11, 1990 when its altitude had dropped to 172 nm.

After retrieval a wide variety of studies was begun of the materials from the spacecraft. (See NASA Conference Publications 3134, 3194, and 3275.) One of these studies involved the removal and gamma-ray assay of approximately 400 samples from LDEF. These samples included about 20 intentional samples of vanadium, nickel, cobalt, indium and tantalum. They were purposely placed at locations throughout the spacecraft expressly for measuring the radioactivity produced while in orbit. In addition, nearly 400 other samples were removed to obtain additional induced radioactivity results. These samples were assigned to the Space Science Laboratory at Marshall Space Flight Center (MSFC), responsible for this study, and to seven other research laboratories having the capability to accurately assay materials with low levels of radioactivity. These seven laboratories included Lawrence Livermore Laboratory (LLL), Lawrence Berkeley Laboratory (LBL), Westinghouse Savannah River Site (SRS), Battelle Pacific Northwest Laboratory (PNWL), Los Alamos National Laboratory (LANL), Johnson Space Center (JSC), and the Tennessee Valley Authority Western Area Radiological Laboratory (TVA). The Department of Physics and Astronomy at Eastern Kentucky University (EKU) provided analytical support to these laboratories and has been involved in the interpretation of the measured specific activities from these measurements. In particular, EKU has performed the task of analyzing the gamma-ray spectra taken at MSFC and in tabulating and comparing the results from the various laboratories.

Under the terms of NASA contract H-13013D, the statement of work called for "work to be performed on data taken in 1994-1995

1. Gamma-ray spectra obtained post-flight from LDEF samples shall be analyzed. Corrections for geometry, self-absorption, detector efficiency and background shall be made. Uncertainties due to counting and experimental errors shall be estimated.

2. The results of these studies in the form of quarterly progress reports shall be made. The contractor shall also assist in preparation of a final report on induced activation analysis of LDEF.

3. Travel to MSFC to consult with NASA personnel on LDEF activation analysis shall be performed.

4. An interface with NASA/Langley Research Center shall be established to develop an LDEF induced activation database at the Langley-LDEF Archive Facility. At least one trip to Langley by the contractor personnel shall be required to perform this task."

This document is the final report on the work performed under this contract.

LDEF-1 Sample and Data Archival

Gamma-Ray Spectra

The intentional and unintentional samples taken from LDEF were distributed to the various counting laboratories previously listed for counting. Many of these samples were counted at MSFC using the low-background counting facility there. The counting facility consisted of a High-Purity Germanium (HPGe) Photon detector placed in a lead and iron shield which was occasionally pressurized with nitrogen to reduce air-borne background. On several occasions spectra were taken without any sample in the facility to identify and quantify the gamma-rays present in the background.

Approximately ninety-five (95) spectra of various samples and about an equal number of calibration spectra were taken with this system. These spectra were analyzed at Eastern Kentucky University to obtain gamma-ray peak areas using three different peak-analysis programs. An earlier version of the SpectraView (SV) program was used interactively to set a linear continuum region as well as a photopeak region. The peak area less the continuum was thus calculated for all spectra. These results were printed to a file for further analysis.

After conversion to a format readable to the Tennelec/Nucleus PCA software package, the PCA program was used to find and analyze peaks. The program uses an algorithm requiring the peaks to meet program specified width and shape criteria. The width parameter can be controlled partially by the user. A report of the results along with the fitting widths, peak centroids, areas, and uncertainties were printed to a computer file and stored. The continuum calculated by this program was linear.

The third program used was the code HYPERMET which had been modified to analyze spectra in the PCA format. As with the PCA program, HYPERMET fits a function to a region of the spectrum. The function that is fit to a clean peak can be varied, but, as used in this analysis, consisted of a Gaussian function for the peak center with a exponential tail on the low-energy side. The continuum was either linear or quadratic depending on the requirement of fitting more than one peak in the spectrum and the presence of Compton edges. Usually, a linear continuum was sufficient. Two computer files are generated by this program. A large file, designated the long (LNG) file, gives a graphical representation of the quality of the fit as well as the results and fit parameters. The second, or

short (SHO) file, gives a brief summary of the results. Because of an unusual structure in some of the spectra caused by electronics fluctuations in the amplifiers, some of the spectra could not be analyzed by this program. The results from all three programs were usually within statistical error. Whenever serious discrepancies occurred, the spectra were carefully studied with SV and PCA to obtain consistent results, or to judge what were the most acceptable results.

SpectraView

SpectraView (SV) is a simple gamma-ray display and analysis program developed to be used with the LDEF gamma-ray spectra found in the archive. The program has been written to display the data directly from the files submitted by the counting laboratories. Virtually all laboratories used different data acquisition systems. The most common was 4K (4096 channels), 4-byte data, ADCAM system at SRS and PNWL while MSFC used an 4K, 4-byte ND66 analyzer, and JSC used an 8K, 4-byte Canberra S-100 system. LLL submitted a 4K text-format data set, and LBL submitted a 4K, 4-byte MicroSampo format data set. These spectral files have been zipped into four 3.5" floppy disks for archival. They should be unzipped with the program PKUNZIP supplied on the disk and, for speed of operation, stored in a single directory on a 486, or comparable, computer with a SuperVGA card. An executable program is supplied for data analysis and a Quick Basic eXtended (QBX) source program is given in case anyone wishes to make program modifications.

SV will display a gamma-ray spectrum and will allow the user to obtain the areas and energies of the displayed photopeaks. The procedure for using this program begins with the initial program execution with the F-KEYS allowing for later changes. The user will be prompted to specify the type spectrum to be displayed. After the spectrum is read, the range of channels and counts will be displayed. After "enter" is hit, a scaling query will be made. The default will display the entire spectrum after which F3 will allow for changes. An initial energy calibration has been set for each type spectrum, but amplifier drifts and shifts along with occasional operator changes necessitates recalibration. The procedures for doing this can be complicated and a recommended procedure is given next.

The channel number and the count in that channel are displayed by using the left and right arrow keys to move the white vertical cursor through the spectrum. The cursor can be moved until it sits on a specific peak--the largest count in a peak. After two peak channels have been selected and their energies determined, a simple slope and intercept can be calculated. ALT-F3 allows you to specify the slope and intercept used

in the program. While the gamma rays seen in each spectrum will usually be different, the background spectra and those LDEF-sample spectra having significant background peaks should contain a 511.0 and a 1460.8-keV peak usable for calibration. After recalibrating, other strong background peaks may be found at 609, 911 and 1115 keV. Energy and efficiency spectra will contain a few or a wide variety of peaks depending on the radioactive source. The peak energies for many spectra can be found in the data analysis sections of this report.

Before doing any determinations of peak area, expand the spectrum until each channel in the peak of interest can be clearly seen. This can be done with the F3 key. The vertical scale should be changed until the region around the peak appears to vary randomly. Then, there are six (6) key settings that must be made with the F4 key. They are background 1 (B1), background 2 (B2), start peak 1 (P1), end peak (P2), background 3 (B3) and background 4 (B4). To integrate the area under the peak, move the cursor to a point of pure background and press F4. This sets B1. Set B2 at a point to the right of B1 where the background still seems to be changing randomly, but before the peak. Then, set P1 where the peak begins and P2 where it ends. Then, set B3 and B4 as you did B1 and B2. Pressing F5 will set a linear background, integrate the peak above the background, and display the results. If the B and P points are not good, press ALT F4 and repeat the process until the background is good. If the cursor "wipes out" any data points, then refresh the screen with F2. Note that this will also wipe out you linear background. Pressing F6 will display the results of the integration, the statistical error, the peak centroid channel, and the peak energy using the resident calibration. You will be prompted as to your wishes about storing the peak results. If you type "yes", the results will be stored in a "binary" file that you name or is named as the default file. Additions are appended to the old file as you specify. The results can be printed when they are viewed with a print screen, or shift print screen, and this is recommended after every ten peaks for future reference. Also, the "binary" file can be printed out later with the PKDPRINT program. The cursor position and the set points are shown with F7.

To rapidly move through the spectrum the F8 key allows you to jump to a specific channel. Also, the arrow key allow you to jump forwards or backwards by a specified number of channels. For example, 20 right arrow will jump 20 channels to the right in the region viewed. Similarly, 20 left arrow will jump 20 channels to the left. If you have broken the spectrum into several smaller groups using F3, using the CTRL right, or left, simultaneously with the arrow will jump to the next, or previous, group of channels. If a peak "runs off' the top of the page, the "page up" key will allow the viewing of the next higher fraction of then spectrum. Pressing "page down" will return to the previous fraction. F9

allows for a jump to the next preset points of peak integration if they have been set. F10 allows for the viewing of a new spectrum without losing the energy calibration. ESC will end the program.

The PKDPRINT program is supplied in the QBX language. In order to get the proper photopeak energies, the slope and intercept for the particular spectrum must be entered into the program. The user will be prompted to make these changes. Also, if a text file of results is desired, the print output should be directed to a computer disk file. Otherwise, a printer must be on-line when the program is run. A partial "print screen" output from the SV program should be used to assure that the correct areas and energies are being printed.

The analysis of these gamma-ray spectra to get the nuclei per kg of material requires a great deal of information other than peak areas and energies. Relative to each spectrum there must be known the live time, the time from the start of counting, and the date of counting as well as the detector efficiency for a particular sample, the self-attenuation of photons by the sample, and the mass and shape of the sample. The sample, the live time, the time and date of counting, and the energy calibration will usually be found in the header of the spectrum. This header can be read with the program HV. This should be run before analyzing a spectrum.

More information about these spectra can be found elsewhere in this report and in the appendices.

HeaderView

HeaderView (HV) is a compiled Quick Basic eXtended (QBX) program written to allow the user to read and, using print screen or shift print screen, to print the information found in the header of the data files. It will read all of the files found zipped on the accompanying disk. There are two sets of text files which should be read with a DOS text editor. These are the files from TVA which gives the header and a listing of the spectra in a channel by channel format. In principle, these could be broken down into individual spectra, rewritten in the LLL format, and viewed with SV. However, time did not permit this to be undertaken.

Gamma-Ray Spectra Analyses

Energy and Efficiency Calibration of the Detector

The interaction of photons with matter results in the presence of a "full-energy" peak in a gamma-ray spectrum. This peak represents the energy of the incident gamma ray with the area related to the number of incident photons. In order to determine the number and energy of the gamma rays producing this peak, an energy and efficiency calibration must be done. In the analysis of the MSFC spectra this was done with sources made by the TVA counting laboratory. These sources had as many as 26 drops of a mixture of radioactive material dried at systematically chosen spots on 2" squares or on a 2" diameter disk. This was done to closely represent the activity of a uniformly-activated flat source. The radioactive material consisted of a mixture of ^{109}Cd, ^{57}Co, ^{88}Y, ^{137}Cs, ^{60}Co, ^{203}Hg, ^{139}Ce, and ^{85}Sr with activities calibrated to 5% or better. These sources give eleven strong, clean gamma rays ranging in energy from 88 to 1836 keV. This energy range covers the ones expected from radioisotopes activated in the LDEF samples. This allowed for energy and efficiency calibration with a single source. Other calibrations were done with calibrated-disk sources, but because the position of the radioactive material could not be located with sufficient accuracy, the flat sources were deemed more reliable in efficiency calibrations.

These flat sources were used with stainless steel, aluminum, and other absorbers to simulate the efficiency of the detector through various thicknesses of these materials. In addition, the efficiency through an aluminum clampplate and through a nickel intentional sample was measured. The absolute efficiency measurements made in this manner were accurate to about six percent depending on the accuracy of the original calibration of the individual gamma rays. Additional statistical error caused by the error in the photopeak area and in peak fitting were included. The error in the energy calibration was about 0.1 keV.

The photopeak efficiencies show a power-function behavior as can be seen in the log-log graph shown in Fig. (1). In order to determine the efficiency for gamma rays of interest a χ^2 minimization fit to efficiency data was performed. The function used for the fit was (Laird91)

$$\varepsilon = \exp\left(a/E_\gamma + b + c(\log E_\gamma) + d(\log E_\gamma)^2 + e(\log E_\gamma)^3\right). \qquad (1)$$

Figure (1) shows the fit of this functional to the data. The variance of the fit from the data point is about 2-3 percent, smaller than the error in the individual efficiencies. This type of fit improves the precision or relative error in the efficiency, but can not improve the overall accuracy, or absolute error.

Because of the relatively large efficiencies for sources placed closed to the detector, there is a possibility that more than one gamma-ray may interact with the detector within the time resolution of the detector-electronic system. This would result in the summing of two or more gammas. Evidence of this was observed in the calibration spectra. However, the evidence showed summing only in the decay cascade for individual isotopes, as in the case of ^{88}Y, with no summing for sources such as ^{137}Cs which emits only one gamma ray. Corrections were made for sum peaks found in the efficiency spectra.

Corrections for Extended Sources

The efficiency of a HPGe detector is dependent on the relative position of the source. Since the detector is almost cylindrical, the usual position of a point source to be studied is along the axis of the cylinder. The efficiency changes for off-axis sources because photons will encounter different amounts of detector material and of absorbing material from the detector housing. Therefore, for extended samples, such as those from LDEF, the efficiency is a complex function of the axial distance of the source and the radial distance perpendicular to this axis. In addition, such extended sources absorb a significant number of photons as they pass through the source itself. This self-absorption must be part of the correction made in source activity determination.

A computer program EFFATN (EFFiciency and ATteNuation) was written to calculate the efficiency and self-absorption correction for the various LDEF samples. The program originally was used to correct the activity of an activated set of samples identical to the intentional samples flown on LDEF. These samples were activated with neutrons at the Indiana University Cyclotron Facility (Laird91). The neutrons were produced from 200 MeV protons striking a lithium target. The neutron beam uniformly illuminated the 2" x 2" x 1/8" samples producing a radioactive source activated uniformly throughout the sample thickness. Corrections for efficiency and self-absorption had to be made for these samples as with those from LDEF.

The method employed in EFFATN is to divide the sample into a large number of discrete, uniformly-activated cells. The detector is assumed to be a cylinder with a given radius and thickness. The radius is

broken up into a number of points, usually 32. The distance from a cell in the sample to a point on the radius of the detector is calculated. The distance through the sample is calculated and the attenuation for a given linear-absorption coefficient is calculated. The correction for attenuation and for decreasing solid angle are averaged over the sample to obtain the correction for a specific linear-absorption coefficient or gamma-ray energy. The only variable parameter is the effective distance from the sample to the detector. The actual sizes of the sample and detector are used in the calculations. In the LDEF calculations the three dimension were broken into 32 x 32 x 32 cells and the detector radius into 32 segments.

The use of an effective detector distance is caused by the interaction of the photons not being at the detector surface. The photon interaction with germanium is of a statistical nature so only an average source-detector position can be determined (Gunnick76). This effective distance is determined by a fit to the efficiency-calibration data.

The point-source, on-axis efficiency changes with distance primarily because of the changing solid angle and of the different average detector thickness. For a very distant point source the detector has an effective thickness equal to the physical thickness. Near the front face photons can pass though the sides of the detector and escape without undergoing full-energy peak interactions. The EFFATN model does not directly account for this effect. In order to approximately correct for this, EFFATN is used in ratio with an actual measurement. As used in the LDEF analysis the ratio of the efficiency and attenuation correction for an extended source to the efficiency of the planar or circular source is calculated. Figures (2) to (4) show the calculated efficiency for a series of stainless steel and aluminum absorbers in comparison with experimental measurements. The linear-absorption coefficients used in these calculations are those from a previous tabulation (Laird91).

In figures (2) through (4) the efficiency through various absorbers is plotted with respect to the thickness of those absorbers. The statistical error and source calibration error is shown by the plotted error bars. The solid lines on these figures are plotted to represent the efficiency including EFFATN correction for that specific set of absorbers in that experimental arrangement. The only adjustible parameter is the effective distance from the detector to the zero-thickness source which is assumed to be constant for all gamma-ray energies.

The accuracy of the EFFATN correction is estimated to be 5 percent. This estimate was originally made for the neutron-activated LDEF-like samples where the correction gave about 5% agreement for radioisotopes such as ^{182}Ta and ^{113}In which emit gamma-rays with

energies from 100 to 2000 keV. The same accuracy can be inferred from figures (5) to (7) in LAIRD91 as well as from the tantalum LDEF samples where the activities of ^{172}Lu gamma rays show agreement from 181 keV to 1094 keV. In two cases an LDEF nickel sample and an identical aluminum sample were counted with calibration sources placed in front and back. In both cases the EFFATN correction gave results consistent with the logarithmic average of the front and back measurements.

The various counting laboratories had the responsibility to determine the efficiency and self-attenuation corrections for their detector systems. The exact technique used should be ascertained from the individual reports. In doing this each laboratory was offered the use of calibration sources produced by TVA. The two most common techniques were the logarithmic average and the use of an analytical code. The computer spectrum analysis code GAMANAL has an efficiency and attenuation algorithm developed by Gunnick (Gunnick76). This code is more sophisticated than EFFATN but has a similar conceptual base. Winn (Winn92) used an analytical technique similar to the discrete element method of EFFATN. Here, he measured the efficiency of his detectors as a function of distance from the detector and from the detector axis using NIST-based sources. Then, using published linear-absorption coefficients, he parameterized the efficiency in terms of a radial-averaged efficiency with an exponential attenuation. An integral average of this function over the dimension of the sample gave his correction. He reported an accuracy of 5% based on his study of the trunnion layers. He also concluded that the use of a simple exponential average (considering thickness only and no radial consideration) underestimated the correction leading to an overestimation of sample activation.

LDEF Activation Results from Spectral Analyses

The materials taken from LDEF for assaying included the intentional samples, aluminum clamp plates, aluminum scuff plates, titanium bolts, lead ballast, and stainless steel trunnions. The trunnions were subsequently cut in lengths varying from 0.5 to 2 inches (NASA Conference Publications 3134, 3194, and 3275, Winn91, or Moss91). Several two-inch sections were then sliced cylindrically into six layers and a core. These cuts were such that after flattening layers 2 through 6 were almost 2 inch square. These sections, layers and cores were distributed with the other samples for counting.

Trunnion Layers

Most of the sample spectra taken at MSFC were from trunnion layers. These included some LHL and RHL trunnion layers from all four sides of the spacecraft and LHG layers from the space side. Also, layer 1 samples from LHD were counted, but no other #1 layers were counted at MSFC. The layers from LHG Space End were counted twice to improve statistics, but LHGSP3 and LHGSP6 were not counted, perhaps because of confusion in the data book.

The trunnion layers were counted over a period of 373 days from retrieval. Since only two radioisotopes (^{57}Co and ^{54}Mn) from those anticipated in stainless steel have half lives greater than 84 days, the activity of only those two isotopes could be observed throughout the period of counting. In the case of ^{57}Co the activity was hard to measure because of the weakness of the peak compared to the background continuum. This was partially due to the large self-absorption for this gamma ray. The activity of ^{54}Mn could be measured to an accuracy of better than 15% in all cases except for the #1 layers from section D where counting statistics were poor. Therefore, this isotope is the most reliably measured of those observed in the samples.

Gamma rays from ^{60}Co and ^{46}Sc were observed in many of the samples. However, the ^{60}Co gamma rays and a 1120-keV gamma ray (close to the ^{46}Sc 1115 keV peak) were observed in the background. The ^{60}Co gamma rays were so strong in the background that any quantitative measurement would be unreliable. Also, after correcting for the 1120-keV peak, there was seldom confirmation from the 1115-keV gamma ray that ^{46}Sc was present in the amount indicated by the 889-keV gamma ray. Also, the presence of the 847-keV peak from ^{56}Co in the background made quantification of the ^{56}Co isotope uncertain. The observation of ^{207}Bi showed its presence as a contaminant although it was not commonly

identified in the background spectra. A complete tabulation of the results for the trunnion layers is given by run number in Appendices B, C, and D and a summary is found in Table I.

Trunnion Sections

Fourteen spectra were taken with six trunnion sections. The gamma rays observed were essentially the same as in the layers. Since they were counted earlier than most of the layers, the statistical accuracy of the measurements was greater allowing for the determination of the activity of some shorter-lived isotopes along with ^{54}Mn and ^{57}Co clearly seen in the layers. In particular, ^{58}Co and ^{46}Sc could be measured with reasonable accuracy. While the 847-keV line for ^{58}Co still is slightly contaminated, enough of a signal above background is present to allow for a clear measurement. The 889-keV line for ^{46}Sc is generally strong and the 1120-keV peak is sufficiently above background to be used for confirmation. A complete tabulation of the results for the trunnion sections is given by run number in the appendix and a summary is found in Table II.

Isolation-Plate Strip Test

Three files were labeled BESTP1, BESTP2, and BESTP3. The last file was the total measured activity for a 2.8-day period (244800 sec). The data book identifies these spectra as from "strip" material from experiment A0114 at location C9. This sample was counted in the mount with collar. These spectra show the presence of ^{207}Bi (569 and 1063 keV) and of ^{7}Be (477 keV). The Bi is background at a level of 94 counts per day with the ratio of the two peak areas agreeing with the known branching ratios. The ^{7}Be is definitely present at the very low level of 0.42 $\pm$ .24 Bq (1.1 pCi) assuming a surface activity. No other activities above background were noted. Table III summarizes these activities.

Ballast

Three specific spectra were identified as samples from the LDEF ballasts. PBBUP and B816B2 were identified as lead while B816B1 was specified as aluminum. All three samples showed the peaks associated with ^{207}Bi (569 and 1063 keV), but at levels at or below background levels. Also, a peak at 847 keV probably from ^{58}Co which appears to be background. Thus, no significant activity was observed in these samples.

Thermal-Isolation Plates

The MSFC data book has six entries dealing with spectra taken from a thermal isolation plate, or plates (ISOPL1 through ISOCAL6). Five of these are identified as "Exp A0114 C9 Thermal Iso. Plate" with spectrum 65 being "Isolation Plate C3-Exp A0114". ISOCAL6 is further labeled as "stripped". The detector-to-source distance is stated as about "1 3/8" inch. Spectrum "ISOCAL" taken for efficiency determinations is apparently at an different distance. Two non-background gamma rays identified in these spectra. These were the 1274 keV from ^{22}Na found in all of the spectra and 477 keV from ^{7}Be found in strongly in four but only weakly in ISOPL6 and not at all in ISOPL4. Because of the confusion about the calibration spectrum, no final results were determined for these spectra.

Clamp Plates

Six aluminum clamp plates were removed from the spacecraft and assayed. These plates were used to hold experimental trays in position during the mission. Four of these plates were 5" x 1 15/16" with a thickness of 0.186". Two had extensions at one corner making them slightly L-shaped and more massive. Special calibration measurements were using the 2" x 2" TVA source. First, the source was counted to simulate a 2" x 6" planar source. Then, the same arrangement was counted through a 2" x 6" x 1/16" aluminum plate. This data was modeled with EFFATN to assure a good efficiency and attenuation correction. Table IV give a summary of the calculations used to find the specific activity of the 1274 keV ^{22}Na activated in the samples. The 511 keV gamma ray is unreliable for the assay process because of the strong background signal and the difficulty in pin pointing the exact position of positron annihilation in the sample. The 511 keV results indicative of this unreliability.

Intentional Samples

In the original plan to measure the induced radioactivity in LDEF samples were to be "intentionally" placed at various places in the spacecraft to obtain a distribution of activity. Twenty such samples of elemental Vanadium, Cobalt, Nickel, Indium, and Tantalum having dimensions of 2" x 2" x 1/8" were used although one of the nickel samples (from tray H12) was cut into two pieces with a composite dimension of 2" x 1.5" x 1/8". Four of the nickel samples and one of each of the other samples were counted at MSFC. The results of the analysis of the gamma-ray data are found in Appendix C. A summary of these results is

found in Table V. Also, Table VI gives an updated summary of the activation measurements originally presented by Armstrong (Armstrong93).

When the MSFC intentional sample activities were originally reported (Armstrong93), an error had been made in the analysis of three of the nickel samples. These were from trays H12, G12, and F2. At the time of counting these samples were placed at positions closer to the detector than the other intentional samples and most of the trunnion pieces. Thus, the detector efficiencies used in the analysis were incorrect. This error has been corrected and the correct activities are shown in Tables V and VI.

The background subtraction for the H12 nickel and IC9 cobalt samples have been of concern because of the self shielding of the samples. For instance, the vanadium sample (IC9) as well as the indium and tantalum samples show evidence of an 847-keV gamma ray, apparently from ^{56}Co. These samples are not expected to have gamma rays from this isotope in their spectra, so the observed activities represent partially-shielded background activities. If the vanadium, indium, and tantalum spectra are used to determine the background activity for the 847-keV peak, the result is 70, 63, and 56 counts per day, respectively. Using an average of these, the 847-keV ^{56}Co yield for H12 Nickel is 48 pCi/kg, compared with 31.2 pCi/kg found in Table V. While this may seem significant, these data have errors as great as their difference and the measurements were taken three half lives after activation. Furthermore, the use of the more appropriate background from vanadium, its absorption more nearly equals nickel, would reduced the 48 pCi/kg result to 40 pCi/kg, in closer agreement with the 31.2 pCi/kg value. A similar calculation for the 889 keV peak from the IC9 vanadium sample yields 22.8 pCi/kg compared with 21.1 pCi/kg in Table V, a difference well within the experimental error. In the case of ^{56}Co in H12 nickel, the use of the background from spectrum 172 is as justified as in any other spectrum analysis.

The comparisons given in Table VI show general agreement between the MSFC measurements and those at other labs with two exceptions. This agreement includes the G12 nickel counted at LLNL and the nickel F2 counted at LBL. Also, there is agreement with the vanadium C9 results from SRL and JSC, with the tantalum C3 results from JSC, and with the indium C9 results from LBL. In comparison with LBL, the MSFC results for cobalt C9 are about a factor of two higher. However, the H12 nickel results are a factor of two lower in comparison with the Battelle results. No experimental or analytical error can be found for these differences.

Considerable disagreement in the measured results for ^{57}Co occurs between counting laboratories. This probably does not represent a serious disagreement for two reasons. First, the gamma ray used to assay for ^{57}Co is at 122 keV. This is where the background continuum is large, at least in the MSFC counting arrangement. This causes considerable difficulty in subtracting the continuum from the peak. Second, at this energy. the correction for attenuation effects are large. Systematic uncertainties in the sample-to-detector distance and in the sample dimensions as well as the continuum subtraction make this gamma ray the most unreliable of those used in the activity measurements.

LDEF Gamma-Ray Data Archive

The gamma-ray data supplied by the counting laboratories have been transferred to 3.5" floppy disks along with the SpectraView and HeaderView analysis programs. These have been given to the Dr. Alan Harmon of the Space Science Laboratory at MSFC for insertion into the LDEF Archive to be established there.

The gamma-ray data supplied by the counting laboratories are stored in the following formats:

1. Lawrence Livermore Laboratory-- Text, 4K spectra, 8 channels per line preceded by header information. There are only 22 spectra in this data set.

2. Savannah River Laboratory-- ORTEC ADCAM, 32 byte header followed by 16 K bytes of data, 4 bytes per word--the order is low byte, mid1, mid2, high. The PEAK4K.BAS program properly reads and displays the data. There are 93 spectra occupying 1.5 Mbytes of memory.

3. Marshall Space Flight Center--ND66 data format, 512 byte header followed by 16 Kbytes of data, 4 bytes per word. Every 512 byte sector is identified by the HEX characters 0A. This starts with byte 513. The PEAK4K.BAS program reads and displays this data. There are 198 spectra occupying 3.3 Mbytes of memory.

4. Pacific Northwest Laboratory-- ORTEC ADCAM, 32 byte header followed by 16 K bytes of data, 4 bytes per word--the order is low byte, mid1, mid2, high. The PEAK4K.BAS program properly reads and displays the data. There are 23 spectra occupying 0.4 Mbytes of memory.

5. Lawrence Berkeley Laboratory--modified Canberra S100 format, less than 4K, but PEAK4K.bas reads it--S100 system will not. The data set has been modified to analyze with MicroSAMPO. There are 148 spectra occupying 2.5 Mbytes of memory.

6. Johnson Space Center--CANBERRA S100 data format, 128 byte header followed by 32 K bytes of data, 4 bytes per word--the order is low byte, mid1, mid2, high. PEAK8K.BAS will display these files properly. There are 131 spectra occupying 4.3 Mbytes of memory.

There is no original gamma-ray data from Los Alamos National Laboratory or from Tennessee Valley Authority.

The SpectraView program is a relatively simple QuickBasic eXtended (QBX) program that can be used to view the spectra, determine the counts in various channels, and determine the area under a photopeak above the continuum. The peak areas are listed in a user specified file. These files can be listed with the PKDPRINT.BAS program. A list of F-key applications used in the program are given at the end of this paragraph. F1 will allow you to view these options while the program is in use. The program should run on any PC-type computer with a 286 microprocessor or higher and may run with BASICA or other BASIC language versions. It might run on a MACINTOSH using the QUICKBASIC software for that system.

```
PRINT
PRINT "       Help Screen For Peak Area Printer   "
PRINT "       ----------------------------- "
PRINT
PRINT "   F1      : Help "
PRINT "   F2      : Clears Settings & Redraws Screen  "
PRINT "   F3      : Sets Page Size (Scale) "
PRINT "   Alt + F3 : Sets Energy Calibration "
PRINT "   F4      : Sets Marked Point "
PRINT "   Alt + F4 : Unsets Marked Point (If Set) "
PRINT "   F5      : Integrate Peak Defined By Settings "
PRINT "   Alt + F5 : Undo Last Integration"
PRINT "   F6      : Show Peak Area Data "
PRINT "   Alt + F6 : Print Peak Area Data To Printer "
PRINT "   F7      : Shows current settings  "
PRINT "   F8      : Jump to a specified channel #"
PRINT "   F9      : Next peak (Based on preset points)"
PRINT "   F10     : Load new spectrum"
PRINT "   Esc     : Exits Program"
```

The program defaults to an energy calibration that is associated with the type of spectrum being view. It is recommended that the user improve the calibration by finding the 511 and 1460.8 keV background peaks. After calculating the slope and intercept, ALT F3 will allow the USER to change the calibration. The background is determined by selecting two data points on either side of the peak with the peak defined by a point on either side. The order of setting the points is background 1 (B1), B2, Peak 2 (P1), P2, B3, and B4. The average background between B1 and B2 and B3 and B4 is calculated along with the average channel in each region. Using the generated slope and intercept, a linear background is subtracted from each channel from P1 to P2, and the area under the peak is summed. The peak and the linear background are

displayed for visual inspection. The peak-area data can then be viewed. No peak fitting is performed and multiple fits are not part of the program. However, judicious use of the background and peak settings can be used to obtain approximate peak areas of resolvable but close peaks. However, high-quality peak fitting of multiplets should be done with a good, well-developed computer-code such as SAMPO, GAMANAL, or HYPERMET.

References

Armstrong93. T. W. Armstrong, B. I. Colborn, B. A. Harmon, C. E. Laird, "Predictions of LDEF Radioactivity and Comparison with Measurements", p. 203, Third Post-Retrieval Symposium, November 8, 1993 (NASA Conference Publication 3275, part 1).

Gunnick76. R. Gunnick and J. B. Niday, "A Working Model for Ge(Li) Detector Counting Efficiencies", Lawrence Livermore Laboratory preprint UCRL-77732, May 5, 1976.

Laird91. C. E. Laird, "Study of Activation of Metal Samples from LDEF-1 and Spacelab-2", Final Technical Report, NASA Contract # NAS8-36649, July, 1991.

Laird92. C. E. Laird, "Analysis, Review, and Documentation of the Activation Data from LDEF Material", Final Technical Report, NASA Contract # H-08071D, July, 1992.

Moss91. Calvin E. Moss and Robert C. Reedy, "Measurements of Induced Radioactivity in Some LDEF Samples", LA-UR-91-2540, Los Alamos National Laboratory, 1991.

Winn91. W. G. Winn, "Gamma-Ray Spectrometry of LDEF Samples", WSRC-RD-91-16, Savannah River Site, 1991.

Figure 1. Efficiency from TVA14 Calibration

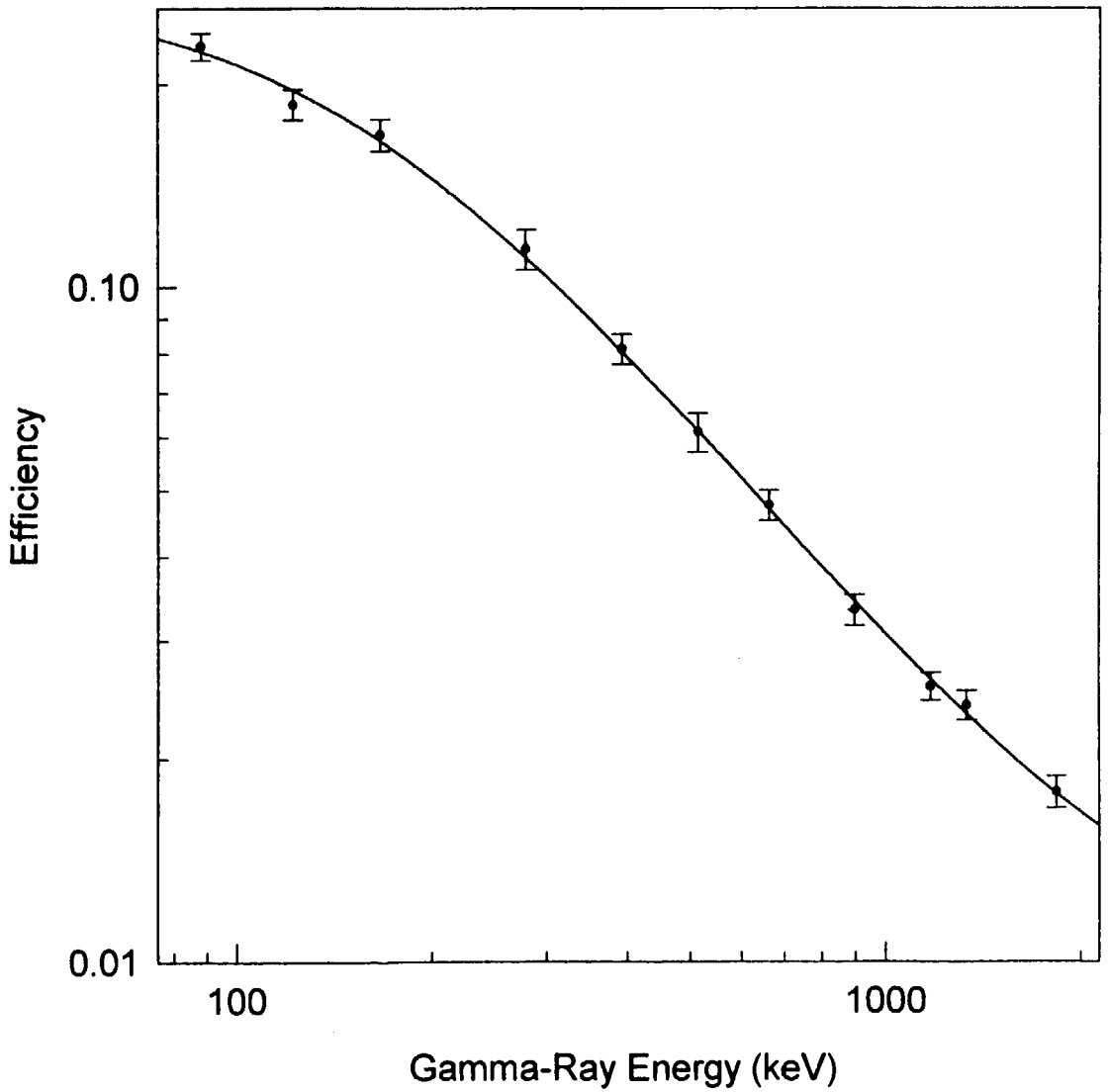

Figure 2(a). Efficiency and Attenuation for Stainless Steel Squares.

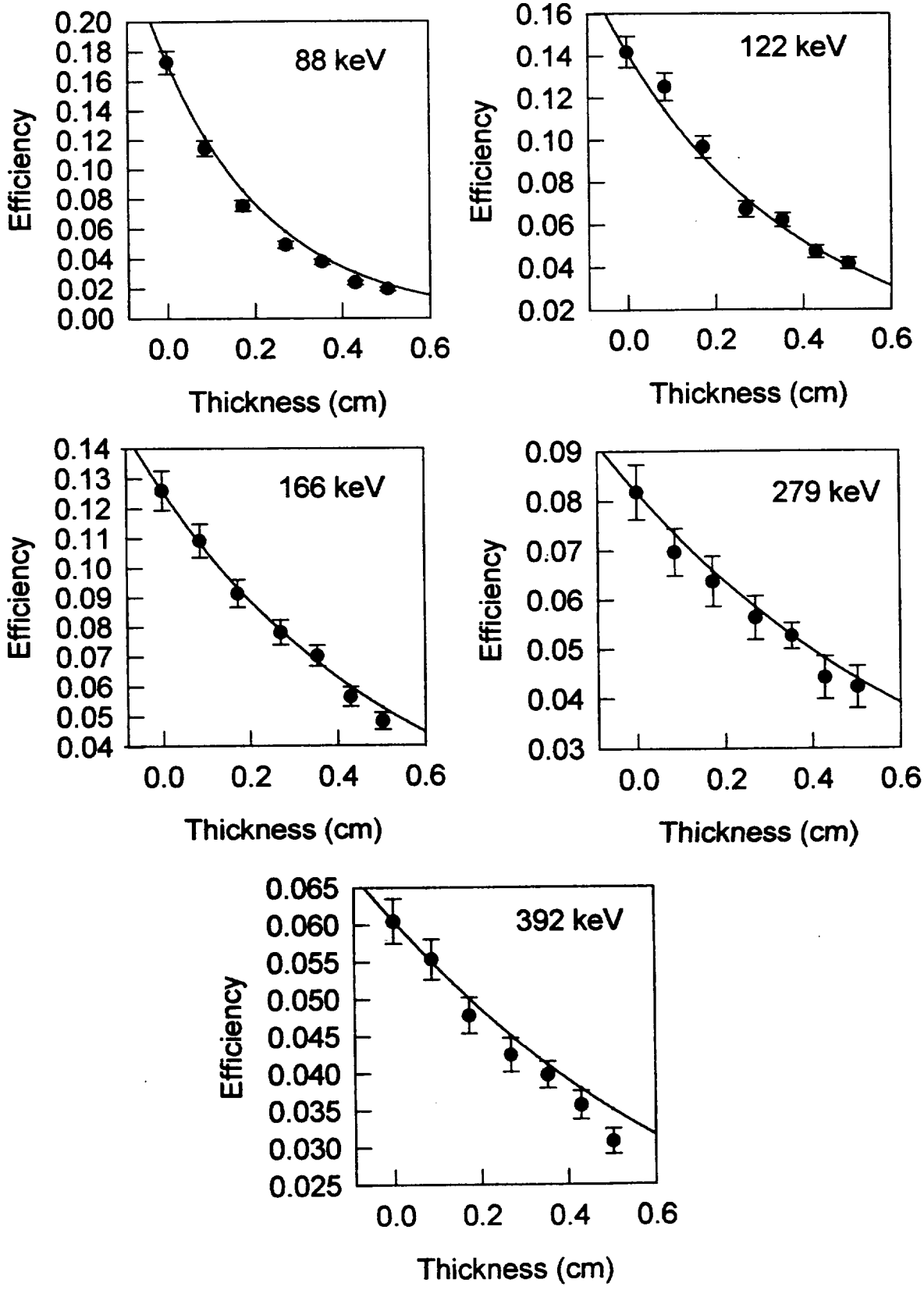

Figure 2(b). Efficiency and Attenuation for Stainless Steel Squares.

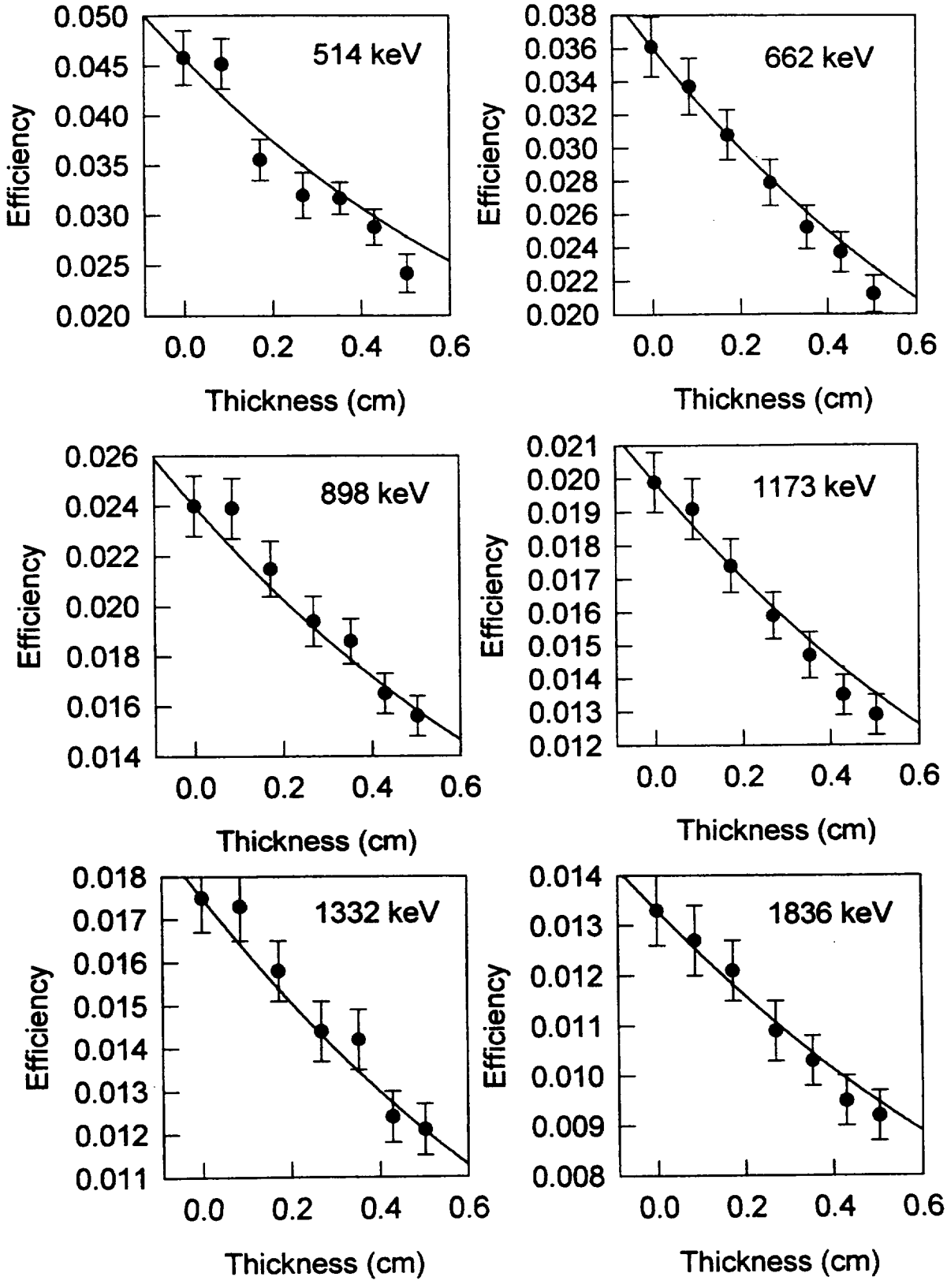

Figure 3(a). Efficiency and Attenuation for Aluminum.

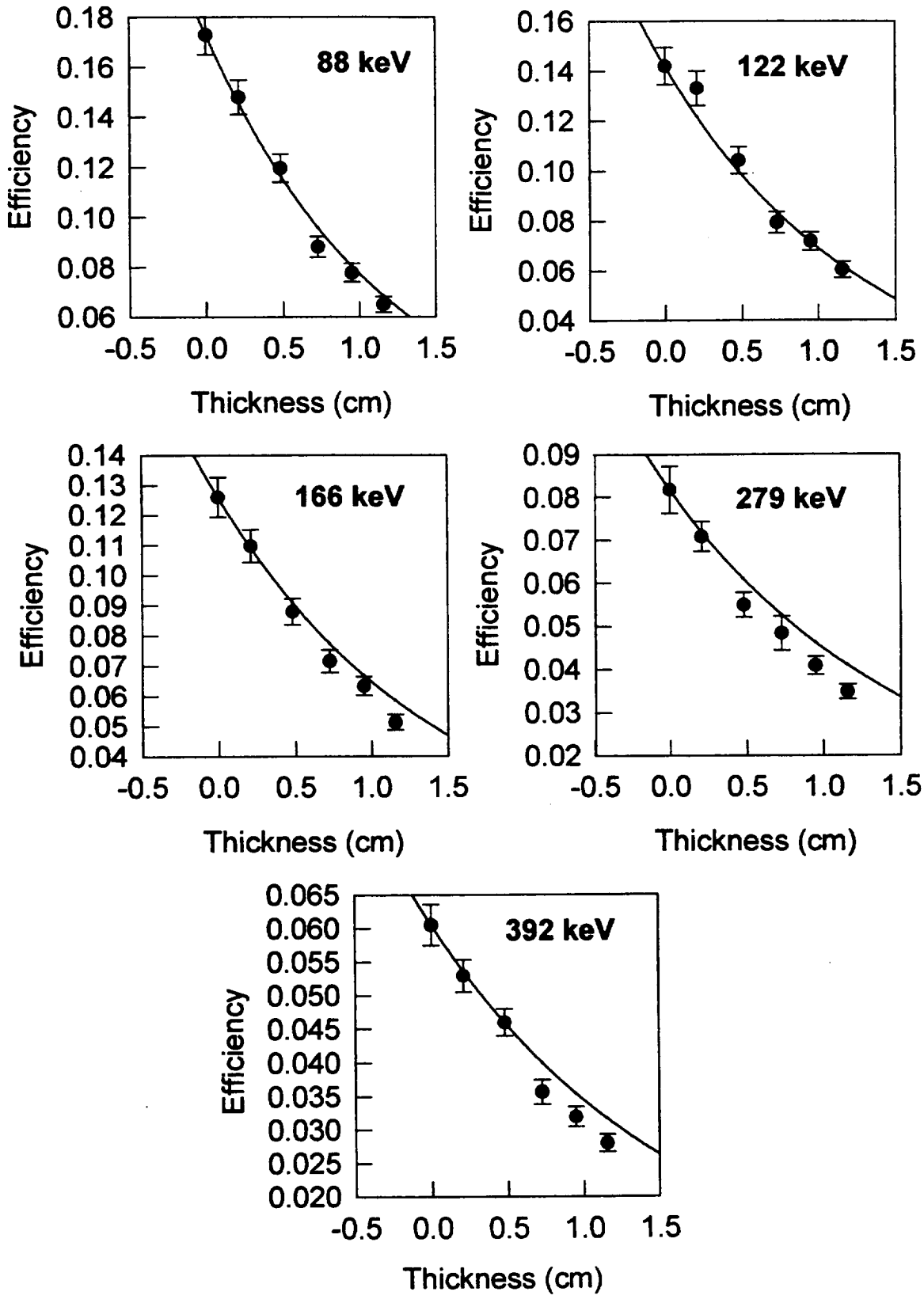

Figure 3(b). Efficiency and Attenuation for Aluminum.

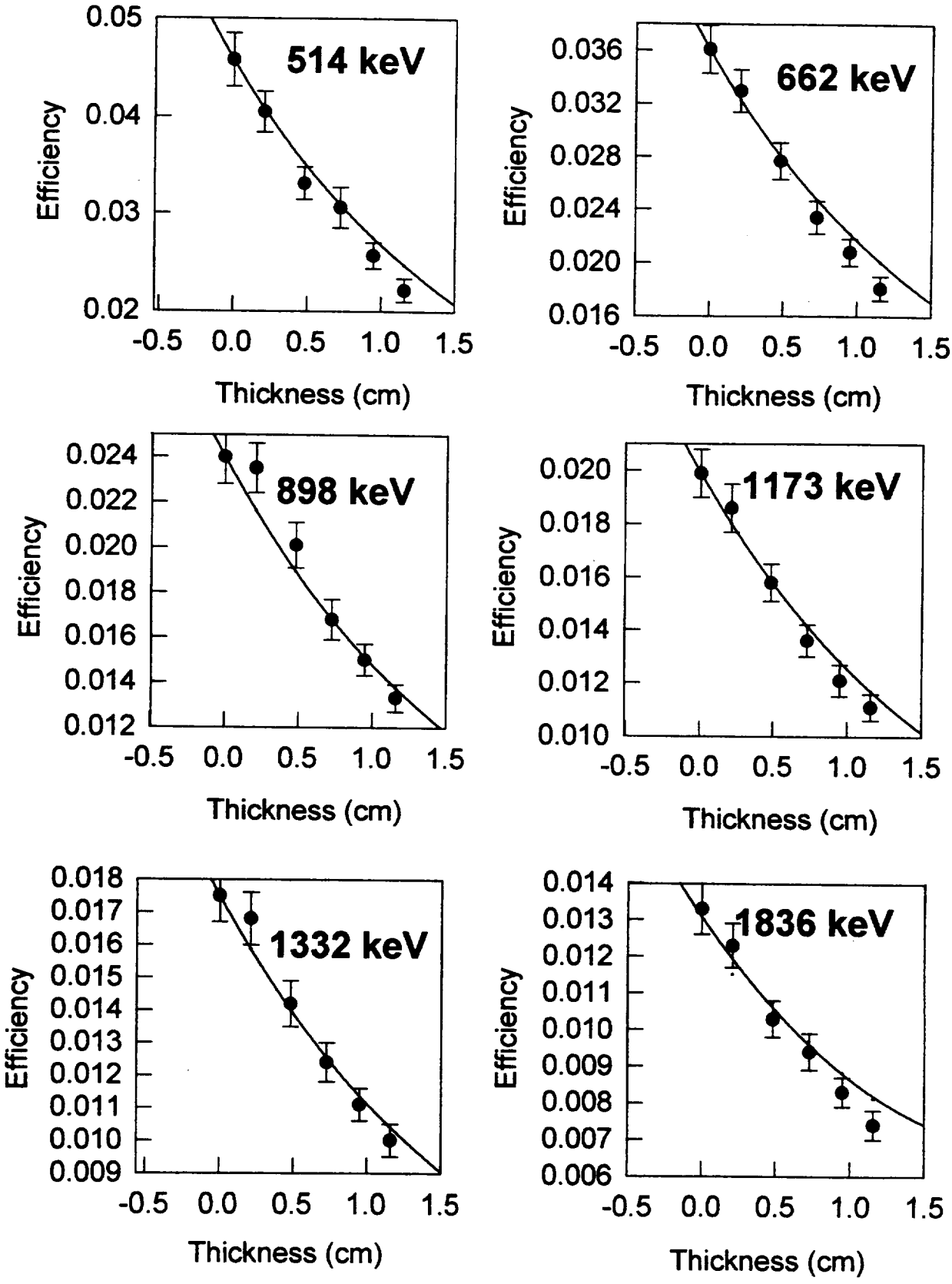

Figure 4(a). Efficiency and Attenuation for Cylindrical Stainless Steel Absorbers.

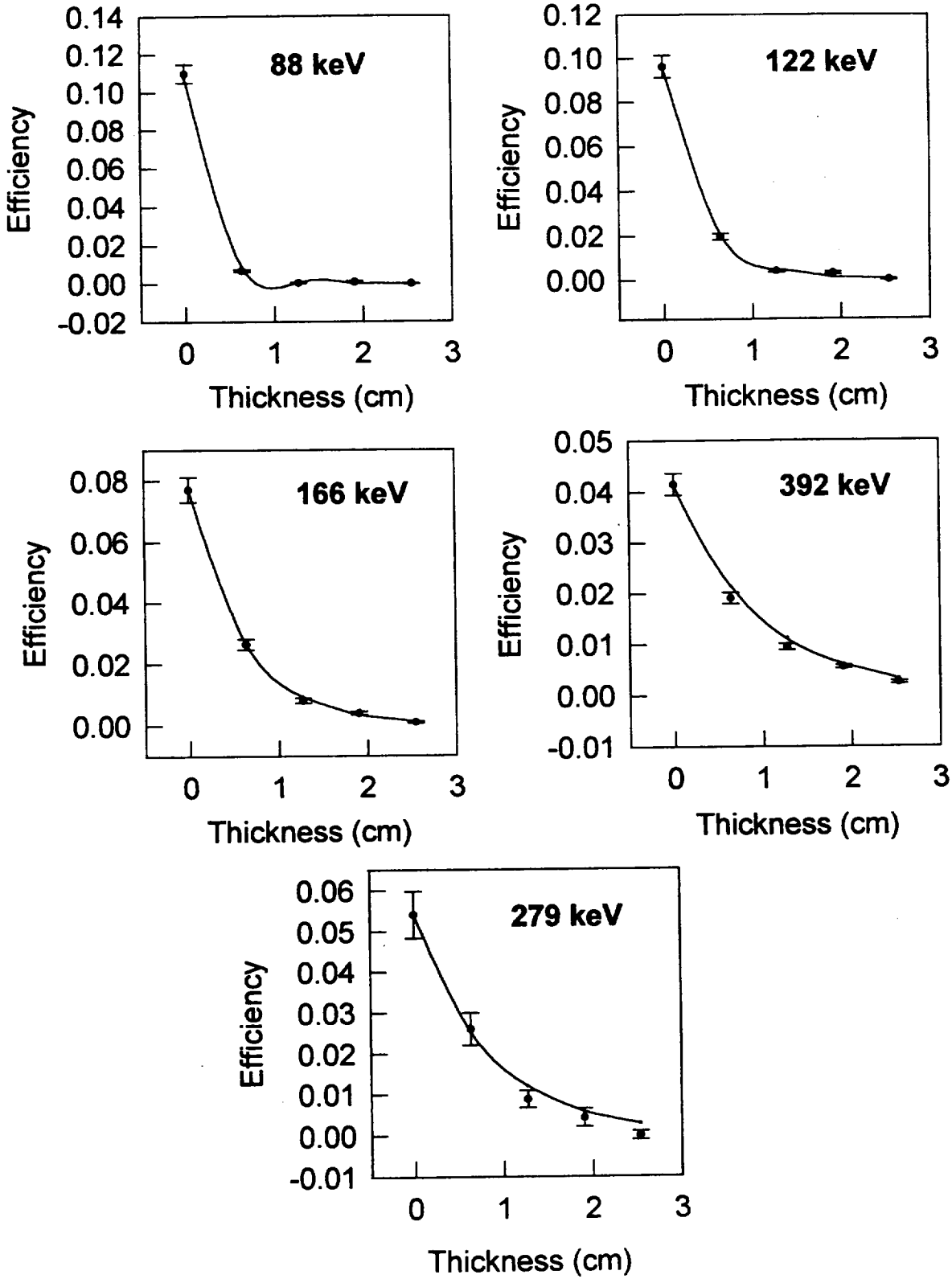

Figure 4(b). Efficiency and Attenuation for Cylindrical Stainless Steel Absorbers.

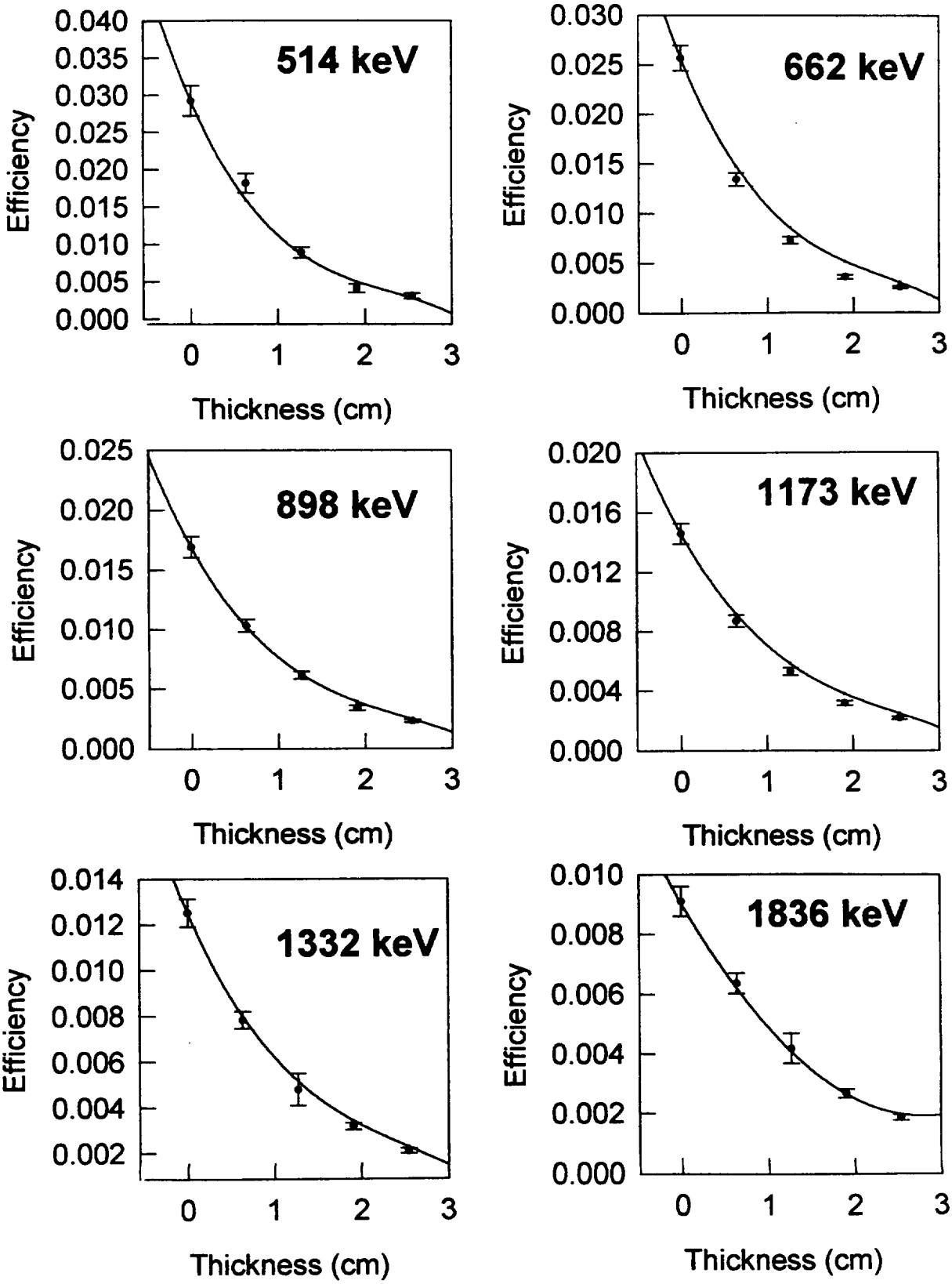

TABLE I. Trunnion Layer Specific Activities

File Name	RUN	time	MASS	Co57	122	Co56	847	Mn54	834	Co58	811	Sc46	889	Sc46	1120
	NO.	days	gm	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err		
ETD1EA	8	37.52	23.70	11.5	42.7	14.4	79.2	51.6	18.4						
ETD1SP	9	38.02	23.70	19.3	47.5	40.7	44.4	89.5	21.1						
ETRD1N	12	41.64	20.00	45.0	22.0	21.3	98.0	242.0	10.3						
ETRD1S	13	42.65	20.00	39.6	27.3	20.8	67.0	171.0	12.9			20.8	67.0	13.8	245.0
LHGSP2	44	66.57	33.00	22.7	30.2			118.0	11.7					13.0	235.0
LHGSP3(2)	45	67.66	33.00	17.3	28.3			144.0	9.1						
LHGSP6(4)	84	109.62	68.60	10.5	22.4			101.0	7.3						
LHG4DN	138	132.00	68.60	10.3	31.5	25.0	48.8	90.0	9.0						
LHGSP4	137	196.94	68.60	13.5	26.0	77.1	29.7	113.0	8.4					53.5	58.0
LHGSP5	140	206.45	75.00	10.8	34.0	52.5	49.1	105.0	9.0						
LGSP5D	141	208.60	75.00	13.9	23.6			92.5	8.6						
LGSP61	143	213.68	73.10	20.3	26.0			95.2	10.5						
LGSP62	152	215.63	73.10	14.3	27.3	57.9	42.1	90.9	9.1						
LHLN21	179	321.74	31.50	24.9	27.8			143.0	9.8						
LHLN41	191	377.74	66.60	19.4	26.0			127.0	8.7						
LHLN61	162	251.70	72.10	13.9	27.9	99.8	31.7	94.0	8.5					71.4	64.8
LHLS21	178	313.70	32.10	17.6	41.2			116.0	10.9						
LHLS61	163	254.74	72.30	13.3	31.0			77.4	9.5						
LLER21	181	331.60	32.00	34.8	21.6			114.0	12.4						
LLER31	182	345.70	51.10	9.0	64.9	132.0	78.5	99.4	10.3						
LLER41	183	349.70	66.50	18.5	25.9	152.0	58.0	116.0	8.7						
LLER51	186	356.64	74.20	12.5	36.1			88.3	11.7						
LLER52	187	359.58	74.20	11.0	39.5			131.0	8.8						
LLER61	161	249.58	72.50	15.3	32.1			81.2	10.0						
LLSP21	180	327.44	31.30	19.0	31.7			157.0	9.9						
LLSP31	189	368.53	50.50	32.0	19.4			96.9	9.9						
LLSP41	190	372.20	66.00	7.6	48.4			94.2	10.4	201.0	38.8				
LLSP51	188	363.64	74.10	15.0	29.5			93.7	9.1	39.4	5.9				
LLSP61	160	239.61	72.10	10.9	28.5	147.0	20.6	102.0	7.9						
RHLN21	168	277.38	32.10	22.1	30.8			84.5	14.1						
RHLN31	169	282.40	51.20	19.1	25.4			63.3	14.6					74.4	95.8

Table 1 (con'd.). Trunnion Layer Specific Activities.

File Name	RUN	time	MASS	Co57	122	Co56	847	Mn54	834	Co58	811	Sc46	889	Sc46	1120
	NO.	days	gm	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err		
RHLN41	170	286.47	66.00	9.8	38.8	125.0	39.8	84.8	9.9	54.5	63.0	56.9	38.8	96.4	61.7
RHLN51	171	290.48	74.50	12.4	37.4			73.8	9.8						
RHLN61	156	222.74	72.30	13.2	37.6	62.1	45.2	62.2	13.1					54.9	74.0
RHLS21	167	271.60	32.20	22.4	26.2	119.0	66.9	117.0	11.2	125.0	40.0				
RHLS31	166	268.69	51.30	0.0	0.0	86.7	62.0	93.4	10.8						
RHLS41	165	263.60	66.40	6.1	68.3			82.1	9.2						
RHLS51	164	257.40	74.40	10.9	22.9			86.2	7.7						
RHLS61	157	231.49	72.30	13.2	35.5	55.4	49.3	76.0	9.8	115.0	24.2				
RLER21	176	307.70	32.10	16.9	50.4			143.0	10.4						
RLER61	155	226.40	72.30	17.8	25.1	53.8	51.4	74.4	10.7						
RLSP21	177	310.70	32.30	19.0	36.1	134.0	86.2	70.1	17.2						
RLSP61	158	234.40	72.70	10.3	47.1	70.7	41.5	74.2	10.8					104.0	42.2

Table II. Trunnion Section Specific Activities

			pCi/kg	%err	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err	pCi/kg	%err
			MN54		Co-57	122	Co-58	811	C0-56	847	C0-56	1236
ETRADN	1	.840 kg	98.7	6.38	15.7	10.17	1.92	42.57	12.6	43.1	9.21	14.24
WTRBDN	3	.697 kg	48.8	7.01	4.5	26.41	1.18	65.68	5.12	23.35	3.22	47.86
ETRBDN	4	.761 kg	65.7	6.65	6.89	18.78	2.03	39.12			4.32	24.26
WTRADN2	5	.840 kg	48.6	6.85	5.12	12.47	2.6	28.28	2.55	38.68	1.93	60.23
ETRAUP	6	.840 kg	78.5	6.5	9.17	14.19			4.99	20.2		
ETRCDN	7	.583 kg	55.7	6.45	6.6	12.47			2.96	27.3		
WTRCDN	10	.706 kg	44.8	6.51	6.64	13.57			2.26	32.97	3.87	28.29
WTRCUP	11	.706 kg	45.2	6.5	6.86	12.32			6.56	14.99		
WTADN2	14	.840 kg	63.1	6.44	4.82	17.28			3.87	24.97		
WTADN3	15	.840 kg	62.7	6.22	8.01	10.87			3.51	21.89	2.97	36.54
ETRMDN	16	1.058 kg	52.2	6.52	5.21	20.45	3.85	22.81			6.09	17.08
ETRMUP	17	1.058 kg	54.2	6.53	4.38	24.26	5.83	18.3	5.74	17.8	4.22	32.73
TRRHMD	39	1.042 kg	44.8	6.3	4.59	17.24	2.38	27.39				
TRRHMU	40	1.042 kg	43.5	9.07	9.9	28.36			1.77	113.49		
			Cr-51	390	Sc-46	889	Sc-46	1120	56NI		V48	
ETRADN	1	.840 kg	27	47.7	4.84	21.06	3.55	34.18	89.9	34.5	5.63	41.29
WTRBDN	3	.697 kg	30.3	47.39	0.974	109.58						
ETRBDN	4	.761 kg	24.1	60.06	1.55	50.19	2.74	41.04			3.87	67.1
WTRADN2	5	.840 kg			3.5	24	3.06	35.1			2.3	78.57
ETRAUP	6	.840 kg			3.51	25.36	1.44	71.03				
ETRCDN	7	.583 kg			3.38	21.17	2.36	44.69				
WTRCDN	10	.706 kg					2.62	39.34				
WTRCUP	11	.706 kg			1.95	27.76	0.83	111.73				
WTADN2	14	.840 kg					3.22	40.27				
WTADN3	15	.840 kg			2.02	28.02	1.64	66.62				
ETRMDN	16	1.058 kg			3.52	22.19	2.24	52.17				
ETRMUP	17	1.058 kg			6.09	16.95	1.11	99.68				
TRRHMD	39	1.042 kg			2.64	22.31	0.779	143.52				
TRRHMU	40	1.042 kg					1.6	133.44				
			V48									
ETRBDN	4	.761 kg	5	53.36								

Table III. Activity of Isolation-Plate Material

Be-7 Activity on Isolation-Plate Strips.						477 keV Gamma Ray	
File	Area	%err	Livetime	EOB(d)	Eff	Act (Bq)	Act (pCi)
Bestp1	67.5	33.4	77871	75	4.62E-03	.0722	1.9501
Bestp2	116.3	34.56	230400	75	4.62E-03	.042	1.1356
Bestp3	54	82.49	244800	75	4.62E-03	.0184	.4963
Bestp3	195	22.02	244800	75	4.62E-03	.0663	1.7921
AVE Bestp3	120	60	244800	75	4.62E-03	.0408	1.1028
There is evidence of Bi-207 in spectrum							
Efficiency using TVA 2x2 source mount with collar.							
Be-7 Activity on Thermal-Isolation Plates						477 keV Gamma Ray	
File	Area	%err	Livetime(s	EOB(d)	Eff	Act (Bq)	Act (pCi)
ISOPL1	213	9.55	31631	64	4.62E-03	.6449	17.4289
ISOPL2	660	5.97	86400	64	4.62E-03	.7315	19.7712
ISOPL3	737	5.61	86400	65	4.62E-03	.8065	21.7983
ISOPL4(C3)	0	0	172330	79	4.62E-03	0	0
ISOPL5	687	6.46	97729	82	4.62E-03	.5352	14.4654
ISOPL6	413	11.58	183600	88	4.62E-03	.1587	4.2882
There is evidence of Bi-207 in spectrum							
Efficiency using TVA 2x2 source mount with collar.							

Table IV. Specific Activity of Clamp Plates

Filename	CLD127 R80	CLD252 R72	CLD25D R68	CLD62 R79	CPC097 R24	CPC037 R25
511 Gamma	7344	2784	10526	2821	1569	2569
1274 Gamma	790	348	1279	338	207	324
%err 1274	7.47	8.91	5.08	9.76	12.08	8.95
Livetime (s)	235733	69887	259200	76472	53863	70703
Time from Retr	95	93	83	94	53	54
Halflife correction	1.0718	1.0702	1.0624	1.071	1.0394	1.0402
511 EFFATN	0.0628	0.0628	0.0628	0.0628	0.0628	0.0628
1274 EFFATN	0.029	0.029	0.029	0.029	0.029	0.029
Sample Mass(kg)	0.078	0.078	0.078	0.078	0.107	0.107
511 Act (pCi/kg)	85.95	109.90	112.03	101.77	58.58	73.07
1274 Act.(pCi/kg)	40.04	59.50	58.96	52.81	33.47	39.91
1274 Act 1/20/90	42.92	63.67	62.64	56.56	34.79	41.52
% Error	8.99	10.22	7.13	10.97	13.07	10.25
Absolute Error	3.86	6.51	4.46	6.20	4.55	4.26

Table V. Summary of LDEF Activation from MSFC Measurements.

		Tray H12	Tray G12	Tray C9	Tray C3	Tray F2
		(Space end)	(Earth end)	(leading side)	(Trailing side)	(Trailing side)
		Exp. M0001	Exp. M0002	Exp. A0114	Exp. A0114	Exp. P0006
Activation	Product	Activity	Activity	Activity	Activity	Activity
Sample	Isotope	(pCi/kg)	(pCi/kg)	(pCi/kg)	(pCi/kg)	(pCi/kg)
Nickel	Sc-46				11(40.0)	
	Mn-54	36.1(15.0)	27.2(14.5)		59.9(11.4)	37.8(11.7)
	Co-56	31.2(64)	35(37.5)		79.8(17.5)	35.3(33.7)
	Co-57	319(5.0)	225(6.3)		428(6.1)	222(6.3)
	Co-58		55(17.2)		58.7(23.1)	32.2(28.5)
Tantalum	Lu-172				72.2(9.0)	
	Lu-173				124(20.7)	
	Hf-175				27.4(23.4)	
	Ta-182				36.7(31.5)	
Vanadium	Sc-46			21.1(57.5%)		
Indium	Ag-110m					
	Sn-113			20.7(53.4)		
Cobalt	Mn-54			111(10.9)		
	Co-56			20.4(50.0)		
	Co-57			241(7.1)		
	Co-58			95.5(16.4)		

Table VI. Summary of Sample Activation Results.

Activation Sample	Product Isotope	Tray H12 (Space end) Exp. M0001 Activity (pCi/kg)	Tray G12 (Earth end) Exp. M0002 Activity (pCi/kg)	Tray C9 (leading side) Exp. A0114 Activity (pCi/kg)	Tray C3 (Trailing side) Exp. A0114 Activity (pCi/kg)	Tray F2 (Trailing side) Exp. P0006 Activity (pCi/kg)
Nickel	Sc-46				10.9 ± 3.5 (c)	1.6 ± 0.4 (a)
	Mn-54	36.1 ± 5.4 (c) 72 ± 3.6 (d)	27.2 ± 3.9 (c) 25 ± 3.4 (e)		66.2 ± 5.8 (c)	37.8 ± 4.4 (c) 27 ± 0.9 (a)
	Co-56	31.2 ± 20.0 (c) 70 ± 2.6 (d)	35 ± 13.1 (c) 29 ± 4.8 (e)		65.7 ± 8.6 (c)	35.3 ± 11.9 (c) 33 ± 1.3 (a)
	Co-57	319 ± 16 (c) 395 ± 15 (d)	225 ± 14.2 (c) 403 ± 35 (e)		462 ± 26 (c)	222 ± 14 (c) 322 ± 2 (a)
	Co-58	73 ± 3.4 (d)	55 ± 9.5 (c) 62 ±7.3 (e)		56.8 ± 8.1 (c)	32.2 ± 9.2 (c) 42 ± 1.6 (a)
Tantalum	Lu-172	56 ± 2.1 (h)	40 ± 1 (h)		72.2 ± 6.5 (c) 75 ± 2 (h)	47 ± 1 (h) 36 ± 1.1 (a)
	Lu-173	120 ± 9.8 (h)	171 ± 12 (h)		124 ± 26 (c) 143 ± 5 (h)	91 ± 4 (h) 161 ± 8.3 (a)
	Hf-175	38 ± 5.7 (h)	19 ± 2 (h)		27.4 ± 6.4 (c) 39 ± 2 (h)	25 ± 2 (h) 37 ± 1.9 (a)
	Ta-182	116 ± 8.1 (h)	45 ± 4 (h)		36.7 ± 11.6 (c) 38 ± 2 (h)	135 ± 4 (h) 90 ± 2.3 (a)
Vanadium	Sc-46	21 ± 6.0 (b) 13 ± 1.7 (g)	16 ± 1.3 (b) 16 ± 1.4 (e)	21.1 ± 12.1 (c) 20 ± 1.5 (b) 24 ± 2.0 (h)		17 ± 1.1 (a)
Indium	Rh-102	2.2 ± 0.6 (a)	2.3 ± 0.3 (a)	3.2 ± 0.4 (a)		2.2 ± 0.9 (a)
	Ag-110m	3.2 ± 0.8 (a)	2.3 ± .3 (a)	3.9 ± 0.5 (a)		5.1 ± 1.0 (a)
	Sn-113	35 ± 4.2 (a)	21 ± 1.2 (a) 22 ± 3.8 (e)	42 ± 18 (c) 41 ± 2.7 (a)		54 ± 3.6 (a)
	In-114m	190 ± 115 (a)	35 ± 15 (a)	55 ± 35 (a)		105 ± 20 (a)
Cobalt	Mn-54		91 ± 3.8 (e) 62 ± 1.4 (f)	111 ± 12 (c) 41 ± 1.1 (a)		
	Co-56		22 ± 3.8 (e)	20.4 ± 10.2 (c)		
	Co-57		303 ± 5.4 (e) 211 ± 1.6 (f)	241 ± 17.1 (c) 125 ± 1.6 (a)		
	Co-58		116 ± 20 (e)	95.5 ± 15.7 (c)		

(a) LBL measurements (1991)
(b) SRL measurements
(c) MSFC/EKU measurements
(d) Batelle measurements(1991)
(e) LLNL measurements
(f) LBL measurements (1993)
(g) Batelle measurements(1992)
(h) JSC measurements

TABLE VII. Background Gamma Rays from Spectrum 172.

Energy (keV)	NET AREA (%)	ERROR (sec)	LIVE TIME	SOURCE
86.510	789	25.220	345600.0	BG172inc
110.400	663	36.350	345600.0	BG172inc
140.660	427	43.790	345600.0	BG172inc
198.400	552	30.980	345600.0	BG172inc
242.040	359	33.000	345600.0	BG172inc
279.060	131	44.440	345600.0	BG172inc
294.980	967	16.650	345600.0	BG172inc
351.630	1226	11.260	345600.0	BG172inc
389.700	97	33.000	345600.0	BG172inc
451.340	188	50.530	345600.0	BG172inc
511.000	6905	2.220	345600.0	BG172inc
568.130	173	48.550	345600.0	BG172inc
583.250	123	35.000	345600.0	BG172inc
596.480	155	46.450	345600.0	BG172inc
608.920	1005	10.450	345600.0	BG172inc
696.070	874	21.050	345600.0	BG172inc
803.790	186	25.000	345600.0	BG172inc
816.010	107	49.530	345600.0	BG172inc
847.800	139	25.000	345600.0	BG172inc
882.540	198	49.490	345600.0	BG172inc
911.920	251	31.470	345600.0	BG172inc
933.510	285	33.680	345600.0	BG172inc
960.910	97	33.000	345600.0	BG172inc
1062.240	213	35.680	345600.0	BG172inc
1097.090	50	42.000	345600.0	BG172inc
1120.260	200	32.000	345600.0	BG172inc
1173.070	243	14.000	345600.0	BG172inc
1197.870	307	29.640	345600.0	BG172inc
1239.150	89	30.000	345600.0	BG172inc
1332.100	247	25.000	345600.0	BG172inc
1376.830	65	33.000	345600.0	BG172inc
1460.800	612	6.010	345600.0	BG172inc
1537.220	26	60.000	345600.0	BG172inc
1649.020	42	40.000	345600.0	BG172inc
1765.400	213	11.000	345600.0	BG172inc
1875.210	54	41.000	345600.0	BG172inc
2205.030	108	45.370	345600.0	BG172inc
2221.010	130	36.150	345600.0	BG172inc
2388.740	150	35.330	345600.0	BG172inc
2613.510	105	27.000	345600.0	BG172inc

TABLE VIII. Background Gamma Rays from Spectrum 175.

Energy (keV)	NET AREA	ERROR (%)	LIVE TIME (sec)	SOURCE
86.510	777	26.380	342665.0	BG175inc
112.150	1054	29.790	342665.0	BG175inc
140.660	600	39.330	342665.0	BG175inc
198.400	735	29.250	342665.0	BG175inc
238.700	551	39.380	342665.0	BG175inc
278.000	152	40.000	342665.0	BG175inc
294.980	507	34.910	342665.0	BG175inc
351.630	222	25.000	342665.0	BG175inc
389.700	200	50.000	342665.0	BG175inc
511.000	7066	2.250	342665.0	BG175inc
583.250	207	25.150	342665.0	BG175inc
596.480	155	51.610	342665.0	BG175inc
608.920	323	28.170	342665.0	BG175inc
661.600	95	45.000	342665.0	BG175inc
696.070	689	24.240	342665.0	BG175inc
803.790	226	33.000	342665.0	BG175inc
847.800	202	24.000	342665.0	BG175inc
960.910	272	38.970	342665.0	BG175inc
1120.260	65	55.400	342665.0	BG175inc
1173.070	243	23.460	342665.0	BG175inc
1197.870	307	29.640	342665.0	BG175inc
1239.150	156	38.460	342665.0	BG175inc
1332.100	326	23.930	342665.0	BG175inc
1460.800	644	8.700	342665.0	BG175inc
1764.720	140	37.860	342665.0	BG175inc
1794.530	94	43.620	342665.0	BG175inc
2223.610	67	34.330	342665.0	BG175inc
2614.260	122	27.870	342665.0	BG175inc

TABLE IX. Radioactive Decay Data Used in Data Reduction.

Energy (keV)	BR(%)	$T_{1/2}$ (Days)	unc (Days)	isotope
55.79	23.600	653.350	29.200	TA179
122.06	85.500	271.770	0.050	CO57
136.47	10.690	271.770	0.050	CO57
158.39	98.800	6.100	0.020	56NI
181.56	20.000	683.000	10.960	HF/LU
272.09	18.500	500.393	0.001	LU173
320.08	9.830	27.704	0.004	CR51
336.26	50.100	2.228	0.004	CD115
391.69	64.000	115.090	0.004	SN113
477.61	10.390	53.290	0.070	BE7
697.30	6.820	683.000	10.960	HF/LU
657.76	94.600	249.760	0.040	AG110
810.79	99.500	70.916	0.015	CO58
834.83	99.975	312.200	0.070	MN54
846.81	99.900	77.700	0.500	CO56
889.25	99.984	83.830	0.020	SC46
884.68	72.700	249.760	0.040	AG110
900.79	28.800	683.000	10.960	HF/LU
912.11	14.800	683.000	10.960	HF/LU
983.50	99.990	15.976	0.400	V48
1037.88	14.100	77.700	0.500	CO56
1093.67	63.500	683.000	10.960	HF/LU
1120.51	99.987	83.830	0.020	SC46
1121.30	34.960	114.430	0.040	TA182
1173.24	99.900	1924.000	0.400	CO60
1189.00	16.200	114.430	0.040	TA182
1221.41	27.000	114.430	0.040	TA182
1231.02	11.440	114.430	0.040	TA182
1238.32	67.000	77.700	0.500	CO56
1274.53	99.937	949.730	0.730	NA22
1312.05	97.490	15.976	0.020	V48
1332.50	99.982	1924.000	0.400	CO60
1771.51	15.500	77.700	0.500	CO56
2598.57	16.700	77.700	0.500	CO56

Appendix A. Efficiency and Self-Attenuation Corrections for LDEF Materials.

The following table gives the efficiency and attenuation (EFFATN) corrections for a wide variety of samples shapes and sizes. The corrections are listed in conjunction with the linear-absorption coefficient (μ) associated with the gamma ray encountering the sample and the sample material. The exact value used in the calculation of the absolute sample activity is obtained with a cubic-spline interpolation.

Column	Sample	
A	Trunnion Layer # 1 + TVA1	
B	Trunnion Layer # 2 + TVA1	
C	Trunnion Layer # 3 + TVA1	
D	Trunnion Layer # 4 + TVA1	
E	Trunnion Layer # 5 + TVA1	
F	Trunnion Layer # 6 + TVA1	
G	Trunnion Section A (WTRA) + TVA14	
H	Trunnion Section A (ETRA) + TVA14	
I	Trunnion Section B (WTRB) + TVA14	
J	Trunnion Section B (ETRB) + TVA14	
K	Trunnion Section C (WTRC) + TVA14	
L	Trunnion Section C (ETRC) + TVA14	
M	Trunnion Section M + TVA14	
N	Intentional Sample 2'' x 1.5'' x .127''	H12Ni
O	Intentional Sample 2'' x 2'' x .129''	IC9In
P	Intentional Sample 2'' x 2'' x .133''	IC9V
Q	Intentional Sample 2'' x 2'' x .132''	NIC3 and NIG12B2F
R	Intentional Sample 2'' x 2'' x .117''	IC9Co
S	Intentional Sample 5'' x 1.94'' x .186''	Al Spacer Plates
T	Intentional Sample 2'' x 2'' x .125''	NIF and TA
U	Intentional Sample 2'' x 1 15/16'' x .185''	Al Clamp Plates

V	Trunnion Section Core
W	Trunnion Section B + TVA1
X	Trunnion Section B + TVA1
Y	Trunnion Section + TVA1
Z	Trunnion Section C + TVA1
AA	Trunnion Section M + TVA1
AB	Trunnion Section R + TVA1

Table A1. Efficiency and Self-Attenuation Corrections for LDEF Materials

μ	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
15.0	.417	.376	.244	.176	.151	.126	.029	.028	.034	.031	.035	.043	.058	.193	.193	.187
10.0	.517	.493	.344	.257	.222	.187	.045	.042	.051	.047	.053	.064	.087	.280	.280	.273
5.0	.660	.676	.538	.439	.393	.342	.087	.084	.101	.092	.104	.126	.169	.467	.469	.460
2.0	.778	.836	.748	.673	.633	.585	.203	.192	.230	.211	.236	.281	.358	.695	.704	.696
1.0	.825	.901	.845	.792	.764	.727	.338	.323	.374	.349	.382	.437	.517	.808	.820	.815
.8	.835	.915	.866	.820	.795	.761	.384	.369	.421	.396	.430	.486	.562	.834	.847	.842
.6	.845	.929	.887	.849	.826	.798	.442	.426	.479	.454	.488	.543	.613	.861	.875	.871
.5	.850	.936	.899	.863	.844	.817	.476	.460	.513	.488	.521	.575	.641	.875	.889	.885
.3	.860	.951	.922	.894	.879	.858	.557	.542	.592	.568	.600	.649	.703	.903	.919	.916
.2	.865	.958	.934	.910	.897	.879	.605	.591	.638	.616	.646	.691	.736	.918	.934	.932
.1	.871	.966	.946	.927	.916	.901	.660	.648	.690	.670	.697	.737	.773	.933	.950	.948
.03	.874	.972	.954	.938	.930	.917	.703	.692	.730	.712	.736	.772	.800	.944	.961	.959
.01	.875	.972	.957	.941	.933	.922	.716	.705	.742	.724	.748	.782	.807	.947	.964	.962
.005	.876	.973	.958	.943	.935	.926	.719	.708	.744	.728	.751	.785	.809	.948	.965	.963

Table A1 (cond.). Efficiency and Self-Attenuation Corrections for LDEF Materials

μ	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
15.0	.189	.212	.120	.199	.108	.010	.076	.083	.104	.086	.057	.058
10.0	.274	.305	.179	.288	.160	.017	.114	.124	.154	.128	.085	.087
5.0	.462	.499	.329	.479	.294	.036	.219	.238	.287	.245	.167	.169
2.0	.698	.727	.567	.711	.506	.085	.431	.456	.514	.465	.354	.358
1.0	.817	.836	.712	.826	.633	.153	.586	.607	.657	.616	.513	.517
.8	.843	.861	.747	.852	.663	.181	.626	.646	.692	.654	.558	.562
.6	.872	.887	.784	.879	.696	.222	.671	.688	.729	.696	.609	.613
.5	.886	.900	.803	.893	.713	.249	.695	.711	.749	.719	.638	.641
.3	.917	.927	.845	.922	.750	.327	.747	.760	.791	.767	.700	.703
.2	.932	.941	.867	.936	.769	.383	.774	.786	.814	.792	.734	.736
.1	.948	.956	.889	.952	.788	.456	.804	.813	.837	.819	.771	.773
.03	.960	.966	.905	.963	.803	.521	.825	.833	.853	.839	.798	.800
.01	.963	.969	.910	.966	.807	.543	.832	.839	.858	.845	.806	.807
.005	.964	.970	.911	.967	.808	.548	.833	.841	.860	.846	.808	.809

The column labeled μ lists the linear-absortion coefficients used in the efficiency and self-attenuation corrections in the EFFATN and EFFATNC (C-Cylindrical) programs.

The following table of coefficients used in Eq. (1) will give the detector efficiency for the specified TVA sources in the specified experimental arrangement.

Table A2. Coefficients for TVA Efficiency Calibrations.

Designation	a	b	c	d	e
TVA1	193.2511	-46.33519	20.3162	-3.106055	0.1521919
TVA14	76.01644	-27.28685	12.6205	-2.027843	0.1010724
TVA15	113.0831	-28.48950	12.61118	-1.9862539	0.09509589
TVA17	62.46957	-26.69783	12.34802	-2.004735	0.1008284
TVACP	56.73018	-23.46682	10.82595	-1.741742	0.08655944

Appendix B

Results of the Analysis of Trunnion Material

This appendix contains the results of the analysis of the gamma-ray spectra taken of the sections and layers of these sections taken from the LDEF trunnion. The heading of each table gives pertinent information about the run, or spectrum, number including the spectrum name, the mass of the sample, the acquisition time and the correction to the energy calibration taken from the MSFC spectra and the MSFC data book. The column header gives the gamma-ray energy, the peak area, the efficiency (EFFATN) correction, the corrected efficiency, the activated in pCi/kg (PC/Kg) and that specific activity corrected to January 20, 1990, the propagated error, and the identity of the radioisotope. The error contains the statistical error in the peak area including the error in the background subtraction, the error in the calibration source, and the estimated error in the EFFATN correction. As indicated the asterisk (*) indicates the source of the background subtracted. Before run 172 the subtracted background comes from that spectrum. After run 175 the background comes from run 175. Some spectra were analyzed with no background subtraction and in some cases the spectra were analyzed with several of the peak analysis programs. These latter can be used to judge the effects of the different analyses.

TABLE OF BACKGROUND GAMMA RAY ENERGIES TO BE SUBTRACTED

KeV	NET AREA	%ERROR	LIVE TIME	SOURCE
86.510	789	25.220	345600.0	BG172inc
110.400	663	36.350	345600.0	BG172inc
140.660	427	43.790	345600.0	BG172inc
198.400	552	30.980	345600.0	BG172inc
242.040	359	33.000	345600.0	BG172inc
279.060	131	44.440	345600.0	BG172inc
294.980	967	16.650	345600.0	BG172inc
351.630	1226	11.260	345600.0	BG172inc
389.700	97	33.000	345600.0	BG172inc
451.340	188	50.530	345600.0	BG172inc
511.000	6905	2.220	345600.0	BG172inc
568.130	173	48.550	345600.0	BG172inc
583.250	123	35.000	345600.0	BG172inc
596.480	155	46.450	345600.0	BG172inc
608.920	1005	10.450	345600.0	BG172inc
696.070	874	21.050	345600.0	BG172inc
803.790	186	25.000	345600.0	BG172inc
816.010	107	49.530	345600.0	BG172inc
847.800	139	25.000	345600.0	BG172inc
882.540	198	49.490	345600.0	BG172inc
911.920	251	31.470	345600.0	BG172inc
933.510	285	33.680	345600.0	BG172inc
960.910	97	33.000	345600.0	BG172inc
1062.240	213	35.680	345600.0	BG172inc
1097.090	50	42.000	345600.0	BG172inc
1120.260	200	32.000	345600.0	BG172inc
1173.070	243	14.000	345600.0	BG172inc
1197.870	307	29.640	345600.0	BG172inc
1239.150	89	30.000	345600.0	BG172inc
1332.100	247	25.000	345600.0	BG172inc
1376.830	65	33.000	345600.0	BG172inc
1460.800	612	6.010	345600.0	BG172inc
1537.220	26	60.000	345600.0	BG172inc
1649.020	42	40.000	345600.0	BG172inc
1765.400	213	11.000	345600.0	BG172inc
1875.210	54	41.000	345600.0	BG172inc
2205.030	108	45.370	345600.0	BG172inc
2221.010	130	36.150	345600.0	BG172inc
2388.740	150	35.330	345600.0	BG172inc
2613.510	105	27.000	345600.0	BG172inc

* INDICATES BACKGROUND SUBTRACTED USING BG172inc

LDEF RUN NO. 1
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRADN.PKD Acquisition Time: 0.50 Days
Sample Mass: 0.840000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.41 KeV
Gamma Ray Energy: 122.06 121.52 KeV
SLOPE: 0.999825 INTERCEPT: 0.562256

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	601	0.524	0.1853	0.036358	14.39932	15.7	10.17	CO57
159.934	1.411	113	0.085	0.2540	0.042851	1.98791	89.9	34.50	56NI
320.056	0.814	61	0.462	0.3654	0.035741	12.93123	29.9	43.50	CR51
320.076	0.814	55	0.417	0.3654	0.035740	11.65983	27.0	47.70	CR51
391.154	0.734	9	0.010	0.3865	0.031226	0.33541	0.411	212.66	SN113*
811.180	0.518	32	0.024	0.4535	0.017316	1.38326	1.92	42.57	CO58
834.826	0.511	2078	1.548	0.4561	0.016904	91.58020	98.7	6.38	MN54
846.654	0.507	153	0.114	0.4573	0.016706	6.82793	9.21	14.24	CO56 *
889.586	0.495	79	0.059	0.4617	0.016030	3.67115	4.84	21.06	SC46
983.740	0.472	26	0.019	0.4705	0.014750	1.31303	5.63	41.29	V48
1036.621	0.460	25	0.132	0.4750	0.014132	9.34425	12.6	43.10	CO56
1120.666	0.442	48	0.036	0.4818	0.013273	2.69376	3.55	34.18	SC46 *
1172.237	0.432	31	0.023	0.4856	0.012809	1.80437	1.83	44.47	CO60 *
1331.309	0.405	17	0.013	0.4964	0.011612	1.09053	1.10	81.70	CO60 *

LDEF RUN NO. 3
Energy Calibration: Calibration Spectrum
Spectrum Name: WTRBDN.PKD Acquisition Time: 0.50 Days
Sample Mass: 0.697000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.40 KeV
Gamma Ray Energy: 1332.50 1331.21 KeV
SLOPE: 1.001741 INTERCEPT: -1.026855

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
120.424	2.131	169	0.177	0.2181	0.043065	4.11978	4.50	26.41	CO57
319.751	0.814	57	0.520	0.4173	0.040846	12.74253	30.3	47.39	CR51
810.484	0.518	18	0.016	0.5065	0.019357	0.83888	1.18	65.68	CO58
834.826	0.511	950	0.853	0.5091	0.018870	45.20055	48.8	7.01	MN54
847.047	0.507	78	0.070	0.5104	0.018636	3.76066	5.12	23.35	CO56 *
1120.663	0.442	12	0.011	0.5343	0.014721	0.73179	0.974	109.58	SC46 *
1173.575	0.432	29	0.026	0.5381	0.014178	1.83775	1.86	43.24	CO60 *
1237.596	0.421	24	0.032	0.5425	0.013587	2.36637	3.22	47.86	CO56 *
1332.501	0.405	15	0.013	0.5485	0.012822	1.05028	1.06	89.86	CO60 *

LDEF RUN NO. 4
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRBDN.PKD Acquisition Time: 0.50 Days
Sample Mass: 0.761000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.98 KeV
Gamma Ray Energy: 122.06 121.79 KeV
SLOPE: 0.999404 INTERCEPT: 0.343567

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.571	2.098	261	0.251	0.2026	0.039829	6.30095	6.89	18.78	CO57
319.923	0.814	46	0.385	0.3923	0.038385	10.02247	24.1	60.06	CR51
810.441	0.518	32	0.026	0.4815	0.018402	1.43678	2.03	39.12	CO58
834.336	0.511	1327	1.091	0.4841	0.017952	60.78402	65.7	6.65	MN54
846.049	0.508	68	0.056	0.4853	0.017741	3.15430	4.32	24.26	CO56 *
888.574	0.496	24	0.020	0.4895	0.017018	1.15961	1.55	50.19	SC46
983.118	0.472	16	0.013	0.4982	0.015630	0.84165	3.87	67.10	V48
1119.696	0.442	35	0.029	0.5093	0.014043	2.04932	2.74	41.04	SC46 *
1172.055	0.432	25	0.021	0.5131	0.013535	1.52004	1.54	50.57	CO60 *
1311.042	0.409	16	0.013	0.5223	0.012393	1.08870	5.00	53.36	V48
1331.330	0.405	16	0.013	0.5235	0.012248	1.07417	1.09	80.64	CO60 *

LDEF RUN NO. 5
Energy Calibration: Calibration Spectrum
Spectrum Name: WTRADN2.PKD Acquisition Time: 0.50 Days
Sample Mass: 0.840000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.46 KeV
Gamma Ray Energy: 1332.50 1331.80 KeV
SLOPE: 1.000674 INTERCEPT: -0.196045

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.296	2.106	205	0.179	0.1942	0.038204	4.67424	5.12	19.76	CO57
477.495	0.667	59	0.423	0.4211	0.027868	15.17626	24.1	38.10	BE7
809.729	0.519	44	0.033	0.4694	0.017956	1.83426	2.60	28.28	CO58
834.826	0.511	1054	0.785	0.4721	0.017498	44.87460	48.6	6.85	MN54
846.664	0.507	43	0.032	0.4733	0.017291	1.85405	2.55	38.68	CO56 *
889.973	0.495	58	0.043	0.4777	0.016579	2.60602	3.50	24.00	SC46
985.017	0.471	10	0.007	0.4865	0.015232	0.48900	2.30	78.57	V48
1120.538	0.442	42	0.031	0.4976	0.013710	2.28190	3.06	35.10	SC46 *
1173.464	0.432	-2	-0.001	0.5015	0.013214	-0.11284	0.000E+00	569.38	CO60 *
1238.428	0.420	16	0.018	0.5060	0.012665	1.40434	1.93	60.23	CO56 *
1332.501	0.405	1	0.001	0.5121	0.011970	0.06223	0.630E-01	1201.76	CO60 *

LDEF RUN NO. 6
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRAUP.PKD Acquisition Time: 0.50 Days
Sample Mass: 0.840000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.40 KeV
Gamma Ray Energy: 122.06 121.27 KeV
SLOPE: 0.999488 INTERCEPT: 0.853027

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	349	0.304	0.1853	0.036358	8.36167	9.17	14.19	CO57
320.489	0.813	82	0.621	0.3656	0.035711	17.39754	43.0	34.67	CR51
834.826	0.511	1644	1.225	0.4561	0.016904	72.45324	78.5	6.50	MN54
846.830	0.507	81	0.060	0.4573	0.016703	3.61540	4.99	20.20	CO56 *
889.598	0.495	56	0.042	0.4617	0.016030	2.60236	3.51	25.36	SC46
1119.990	0.442	19	0.014	0.4817	0.013280	1.06576	1.44	71.03	SC46 *
1172.813	0.432	13	0.010	0.4857	0.012804	0.75696	0.767	90.18	CO60 *
1332.011	0.405	21	0.016	0.4964	0.011608	1.34765	1.37	61.15	CO60 *

LDEF RUN NO. 7
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRCDN.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.583000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.41 KeV
Gamma Ray Energy: 1332.50 1331.82 KeV
SLOPE: 1.000533 INTERCEPT: -0.028503

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.396	2.103	509	0.319	0.2704	0.053179	6.00662	6.60	12.47	CO57
135.584	1.765	96	0.482	0.3080	0.057242	8.41770	9.25	49.89	CO57
834.826	0.511	2026	1.087	0.5714	0.021177	51.34554	55.7	6.45	MN54
846.332	0.508	83	0.045	0.5725	0.020921	2.13080	2.96	27.30	CO56 *
888.885	0.496	93	0.050	0.5765	0.020032	2.49135	3.38	21.17	SC46
1120.298	0.442	53	0.028	0.5950	0.016398	1.73442	2.36	44.69	SC46 *
1172.706	0.432	16	0.009	0.5986	0.015782	0.54452	0.552	117.65	CO60 *
1237.510	0.421	16	0.013	0.6027	0.015096	0.84877	1.18	95.69	CO56 *
1332.501	0.405	34	0.018	0.6084	0.014221	1.28305	1.30	61.71	CO60 *

LDEF RUN NO. 8
Energy Calibration: Calibration Spectrum
Spectrum Name: ETD1EA.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.019700 Kilograms. Material : STEEL
Gamma Ray Energy: 122.06 122.08 KeV
Gamma Ray Energy: 510.20 510.30 KeV
SLOPE: 0.999791 INTERCEPT: 0.006462

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.112	2.083	85	1.579	0.7743	0.151869	10.39444	11.5	42.68	CO57
834.112	0.511	94	1.493	0.8494	0.031512	47.37850	51.6	18.40	MN54
846.138	0.508	20	0.318	0.8496	0.031057	10.23592	14.4	79.17	CO56 *
1171.912	0.432	-24	-0.381	0.8534	0.022516	-16.94255	0.000E+00	60.44	CO60 *
1331.099	0.405	-22	-0.349	0.8548	0.020001	-17.46919	0.000E+00	84.95	CO60 *

LDEF RUN NO. 9
Energy Calibration: Calibration Spectrum
Spectrum Name: ETD1SP.PKD Acquisition Time: 0.50 Days
Sample Mass: 0.023700 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 833.90 KeV
Gamma Ray Energy: 1120.51 1119.71 KeV
SLOPE: 0.999559 INTERCEPT: 1.293335

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.381	2.047	86	2.655	0.7759	0.151405	17.53709	19.3	47.49	CO57
834.826	0.511	98	2.588	0.8495	0.031484	82.18761	89.5	21.09	MN54
847.021	0.507	34	0.898	0.8496	0.031024	28.95892	40.7	44.44	CO56 *
1120.510	0.442	-14	-0.370	0.8529	0.023502	-15.72685	0.000E+00	89.38	SC46 *
1173.417	0.432	4	0.106	0.8534	0.022488	4.70006	4.76	307.22	CO60 *
1331.517	0.405	8	0.211	0.8548	0.019995	10.56365	10.7	173.30	CO60 *

LDEF RUN NO. 10
Energy Calibration: Calibration Spectrum
Spectrum Name: WTRCDN.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.706000 Kilograms. Material : STEEL
Gamma Ray Energy: 122.06 121.75 KeV
Gamma Ray Energy: 1332.50 1331.59 KeV
SLOPE: 1.000496 INTERCEPT: 0.250618

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	519	0.269	0.2282	0.044758	6.00915	6.64	13.57	CO57
835.034	0.511	1776	0.787	0.5172	0.019166	41.06768	44.8	6.51	MN54
847.040	0.507	68	0.030	0.5184	0.018930	1.59319	2.26	32.97	CO56 *
1120.486	0.442	64	0.028	0.5420	0.014936	1.89887	2.62	39.34	SC46 *
1172.852	0.432	93	0.041	0.5458	0.014389	2.86662	2.91	21.78	CO60 *
1237.904	0.421	57	0.038	0.5502	0.013778	2.73594	3.87	28.29	CO56 *
1332.501	0.405	18	0.008	0.5562	0.013002	0.61351	0.622	110.34	CO60 *

LDEF RUN NO. 11
Energy Calibration: Calibration Spectrum
Spectrum Name: WTRCUP.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.706000 Kilograms. Material : STEEL
Gamma Ray Energy: 122.06 121.33 KeV
Gamma Ray Energy: 1173.24 1172.33 KeV
SLOPE: 1.000167 INTERCEPT: 0.710670

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	534	0.277	0.2282	0.044758	6.18282	6.86	12.32	CO57
835.300	0.511	1786	0.792	0.5173	0.019161	41.31037	45.2	6.50	MN54
847.563	0.507	195	0.086	0.5185	0.018920	4.57113	6.56	14.99	CO56 *
889.860	0.495	57	0.025	0.5226	0.018141	1.39239	1.95	27.76	SC46
1120.468	0.442	20	0.009	0.5420	0.014936	0.59339	0.830	111.73	SC46 *
1173.237	0.432	40	0.018	0.5458	0.014385	1.23329	1.25	46.91	CO60 *
1332.464	0.405	41	0.018	0.5562	0.013002	1.39741	1.42	52.07	CO60 *

* INDICATES BACKGROUND SUBTRACTED USING BG172inc

LDEF RUN NO. 12
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRD1N.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.020000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.57 KeV
Gamma Ray Energy: 834.83 834.67 KeV
SLOPE: 1.001623 INTERCEPT: -1.198608

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
120.428	2.131	241	4.409	0.7722	0.109373	40.30828	44.9	22.00	CO57
834.826	0.511	307	4.803	0.8495	0.021754	220.78123	242.	10.25	MN54
846.906	0.507	20	0.313	0.8496	0.021435	14.60790	21.3	97.75	CO56 *
1173.324	0.432	-1	-0.016	0.8534	0.015540	-1.00746	0.000E+00	1547.10	CO60 *

LDEF RUN NO. 13
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRD1S.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.020000 Kilograms. Material : STEEL
Gamma Ray Energy: 105.28 105.28 KeV
Gamma Ray Energy: 591.64 591.64 KeV
SLOPE: 1.000000 INTERCEPT: 0.000000

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.108	2.083	211	3.860	0.7743	0.108811	35.47293	39.6	27.30	CO57
835.067	0.511	216	3.379	0.8495	0.021747	155.38469	171.	12.94	MN54
890.343	0.495	19	0.297	0.8502	0.020368	14.59271	20.8	66.99	SC46
1121.233	0.442	10	0.156	0.8529	0.016220	9.64387	13.8	245.01	SC46 *
1237.228	0.421	16	0.374	0.8540	0.014798	25.24047	37.1	99.88	CO56 *

LDEF RUN NO. 14
Energy Calibration: Calibration Spectrum
Spectrum Name: WTADN2.PKD Acquisition Time: 1.00 Days
Sample Mass: 0.840000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.30 KeV
Gamma Ray Energy: 834.83 834.58 KeV
SLOPE: 1.001067 INTERCEPT: -0.644379

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.085	2.112	280	0.122	0.2004	0.028302	4.30906	4.82	17.28	CO57
476.965	0.668	611	2.190	0.4384	0.020262	108.08229	192.	8.36	BE7
834.826	0.511	1932	0.720	0.4910	0.012573	57.23623	63.1	6.44	MN54
846.529	0.507	87	0.032	0.4922	0.012424	2.61032	3.87	24.97	CO56 *
1120.671	0.442	59	0.022	0.5174	0.009844	2.23217	3.22	40.27	SC46 *
1173.427	0.432	25	0.009	0.5215	0.009495	0.98151	0.997	72.19	CO60 *
1238.456	0.420	6	0.003	0.5262	0.009110	0.36609	0.543	213.22	CO56 *
1275.205	0.414	32	0.012	0.5288	0.008911	1.33807	1.38	34.98	NA22
1332.456	0.405	40	0.015	0.5326	0.008628	1.72685	1.75	51.44	CO60 *

LDEF RUN NO. 15
Energy Calibration: Calibration Spectrum
Spectrum Name: WTADN3.PKD Acquisition Time: 1.83 Days
Sample Mass: 0.840000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.49 KeV
Gamma Ray Energy: 834.83 834.57 KeV
SLOPE: 1.001685 INTERCEPT: -1.149994

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
120.244	2.137	846	0.201	0.1984	0.028130	7.14484	8.01	10.87	CO57
476.774	0.668	1109	2.168	0.4383	0.020268	106.97103	191.	7.49	BE7
834.826	0.511	3515	0.714	0.4910	0.012573	56.79993	62.7	6.22	MN54
846.536	0.507	144	0.029	0.4922	0.012424	2.35667	3.51	21.89	CO56 *
889.478	0.495	82	0.017	0.4967	0.011910	1.39868	2.02	28.02	SC46
1120.697	0.442	55	0.011	0.5174	0.009844	1.13503	1.64	66.62	SC46 *
1173.546	0.432	52	0.011	0.5215	0.009494	1.11365	1.13	51.81	CO60 *
1238.405	0.420	60	0.018	0.5262	0.009110	1.99678	2.97	36.54	CO56 *
1332.874	0.405	32	0.007	0.5326	0.008626	0.75371	0.766	105.23	CO60 *

LDEF RUN NO. 16
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRMDN.PKD Acquisition Time: 1.00 Days
Sample Mass: 1.058000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.37 KeV
Gamma Ray Energy: 1332.50 1331.77 KeV
SLOPE: 1.000553 INTERCEPT: -0.005249

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.885	2.089	299	0.103	0.1587	0.022329	4.63051	5.21	20.45	CO57
811.143	0.518	91	0.027	0.4173	0.011013	2.45528	3.85	22.81	CO58
834.826	0.511	1714	0.507	0.4199	0.010754	47.13482	52.2	6.52	MN54
846.322	0.508	145	0.043	0.4212	0.010634	4.03572	6.09	17.08	CO56 *
889.176	0.496	83	0.025	0.4257	0.010211	2.40363	3.52	22.19	SC46
1119.964	0.442	44	0.013	0.4467	0.008504	1.52996	2.24	52.17	SC46 *
1172.753	0.432	65	0.019	0.4509	0.008214	2.34215	2.38	27.01	CO60 *
1237.679	0.421	-1	0.000	0.4557	0.007894	-0.05590	0.000E+00	1525.09	CO56 *
1332.501	0.405	4	0.001	0.4623	0.007489	0.15794	0.161	535.98	CO60 *

LDEF RUN NO. 17
Energy Calibration: Calibration Spectrum
Spectrum Name: ETRMUP.PKD Acquisition Time: 0.97 Days
Sample Mass: 1.058000 Kilograms. Material : STEEL
Gamma Ray Energy: 122.06 121.43 KeV
Gamma Ray Energy: 1332.50 1332.01 KeV
SLOPE: 0.999884 INTERCEPT: 0.645035

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	243	0.087	0.1591	0.022359	3.88277	4.38	24.26	CO57
810.801	0.518	132	0.041	0.4173	0.011017	3.67821	5.83	18.30	CO58
835.348	0.511	1719	0.525	0.4200	0.010749	48.86289	54.2	6.53	MN54
847.057	0.507	131	0.040	0.4213	0.010626	3.76947	5.74	17.80	CO56 *
888.642	0.496	138	0.042	0.4256	0.010216	4.12677	6.09	16.95	SC46
1120.316	0.442	21	0.006	0.4467	0.008502	0.75456	1.11	99.68	SC46 *
1173.019	0.432	22	0.007	0.4509	0.008212	0.81911	0.833	83.52	CO60 *
1238.082	0.421	48	0.022	0.4557	0.007892	2.77285	4.22	32.73	CO56 *
1332.501	0.405	37	0.011	0.4623	0.007489	1.50933	1.54	57.36	CO60 *

LDEF RUN NO. 39
Energy Calibration: Calibration Spectrum
Spectrum Name: TRRHMD.PKD Acquisition Time: 2.00 Days
Sample Mass: 1.042000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.25 KeV
Gamma Ray Energy: 834.83 834.26 KeV
SLOPE: 1.001901 INTERCEPT: -1.019989

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
119.599	2.156	501	0.088	0.1571	0.022347	3.93587	4.59	17.24	CO57
811.392	0.518	97	0.015	0.4222	0.011138	1.31376	2.38	27.39	CO58
835.187	0.511	2837	0.426	0.4249	0.010876	39.16312	44.8	6.30	MN54
889.710	0.495	110	0.017	0.4308	0.010327	1.59912	2.64	22.31	SC46
1121.630	0.442	27	0.004	0.4519	0.008592	0.47178	0.779	143.52	SC46 *
1174.731	0.432	47	0.007	0.4561	0.008295	0.85129	0.870	58.52	CO60 *

LDEF RUN NO. 40
Energy Calibration: Calibration Spectrum
Spectrum Name: TRRHMU.PKD Acquisition Time: 0.22 Days
Sample Mass: 1.042000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.23 KeV
Gamma Ray Energy: 834.83 834.67 KeV
SLOPE: 1.000573 INTERCEPT: -0.322510

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
120.397	2.132	119	0.190	0.1587	0.022486	8.44326	9.90	28.36	CO57
834.826	0.511	302	0.412	0.4248	0.010880	37.87199	43.5	9.07	MN54
846.233	0.508	8	0.011	0.4261	0.010759	1.01524	1.77	113.49	CO56 *
1121.530	0.442	6	0.008	0.4519	0.008592	0.95268	1.60	133.44	SC46 *
1174.551	0.432	7	0.010	0.4561	0.008297	1.15205	1.18	122.45	CO60 *
1333.172	0.405	4	0.005	0.4673	0.007566	0.72125	0.737	166.51	CO60 *

LDEF RUN NO. 44
Energy Calibration: Calibration Spectrum
Spectrum Name: LHGSP2.PKd Acquisition Time: 1.00 Days
Sample Mass: 0.033000 Kilograms. Material : STEEL
Gamma Ray Energy: 121.06 120.60 KeV
Gamma Ray Energy: 1332.50 1332.39 KeV
SLOPE: 0.999711 INTERCEPT: 0.495842

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.061	2.113	202	2.240	0.8291	0.117089	19.12666	22.7	30.24	CO57
834.875	0.511	256	2.427	0.9352	0.023949	101.35042	118.	11.65	MN54
1120.902	0.442	-18	-0.171	0.9402	0.017886	-9.54091	0.000E+00	119.47	SC46 *
1173.607	0.432	42	0.399	0.9410	0.017131	23.26343	23.8	44.47	CO60 *
1332.501	0.405	-13	-0.123	0.9430	0.015277	-8.06795	0.000E+00	161.86	CO60 *

LDEF RUN NO. 45
Energy Calibration: Calibration Spectrum
Spectrum Name: LHGSP3.PKD Acquisition Time: 1.81 Days
Sample Mass: 0.033000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.69 KeV
Gamma Ray Energy: 511.00 510.26 KeV
SLOPE: 0.998138 INTERCEPT: 1.689941

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.568	2.042	276	1.689	0.8334	0.116317	14.51760	17.3	28.32	CO57
477.798	0.667	103	5.186	0.9243	0.042647	121.59991	297.	35.15	BE7
835.601	0.511	565	2.956	0.9352	0.023928	123.55182	144.	9.10	MN54
847.620	0.507	30	0.157	0.9355	0.023581	6.66181	12.3	104.54	CO56 *
899.130	0.493	47	0.854	0.9365	0.022208	38.43999	41.2	46.89	HF/LU
1120.891	0.442	-21	-0.110	0.9402	0.017886	-6.14264	0.000E+00	168.63	SC46 *

LDEF RUN NO. 69
Energy Calibration: Calibration Spectrum
Spectrum Name: RHCOSL.PKD Acquisition Time: 1.75 Days
Sample Mass: 0.559000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 835.60 KeV
Gamma Ray Energy: 122.06 121.83 KeV
SLOPE: 0.998592 INTERCEPT: 0.402466

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	120	0.045	0.0819	0.011505	3.90088	4.87	55.32	CO57
810.370	0.518	32	0.010	0.2436	0.006435	1.59811	3.74	76.57	CO58
834.826	0.511	935	0.299	0.2457	0.006293	47.51889	57.6	7.47	MN54
846.639	0.507	34	0.011	0.2468	0.006228	1.74749	3.79	82.75	CO56 *

LDEF RUN NO. 84
Energy Calibration: Calibration Spectrum
Spectrum Name: LHGSP6.PKD Acquisition Time: 3.26 Days
Sample Mass: 0.068600 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.44 KeV
Gamma Ray Energy: 834.83 834.93 KeV
SLOPE: 1.000419 INTERCEPT: -0.453888

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
120.637	2.125	451	0.738	0.6600	0.093395	7.90187	10.5	22.41	CO57
834.826	0.511	1238	1.732	0.8614	0.022061	78.53231	101.	7.25	MN54
1173.528	0.432	54	0.076	0.8731	0.015897	4.75730	4.95	74.44	CO60 *

LDEF RUN NO. 137
Energy Calibration: Calibration Spectrum
Spectrum Name: LHGSP4.PKD Acquisition Time: 2.00 Days
Sample Mass: 0.068600 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 835.46 KeV
Gamma Ray Energy: 510.20 511.30 KeV
SLOPE: 1.001437 INTERCEPT: -1.834961

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
55.107	6.218	293	2.831	0.3779	0.084775	33.39003	41.2	25.93	TA179
122.393	2.075	286	0.763	0.6652	0.093353	8.16965	13.5	25.95	CO57
139.318	1.696	126	2.687	0.7060	0.091769	29.28376	48.5	104.64	CO57 *
184.202	1.208	111	1.265	0.7646	0.082640	15.31198	18.7	70.22	HF/LU
697.168	0.557	-234	-7.823	0.8549	0.026475	-295.48096	0.000E+00	44.73	HF/LU*
834.826	0.511	704	1.606	0.8614	0.022061	72.77593	113.	8.36	MN54
846.833	0.507	126	0.288	0.8619	0.021748	13.22268	77.1	29.73	CO56 *
1119.685	0.442	76	0.173	0.8716	0.016597	10.44159	53.5	58.03	SC46 *
1174.033	0.432	21	0.048	0.8732	0.015890	3.01611	3.24	158.68	CO60 *
1332.480	0.405	59	0.135	0.8773	0.014212	9.46672	10.2	70.81	CO60 *

LDEF RUN NO. 138
Energy Calibration: Calibration Spectrum
Spectrum Name: LHG4DN.PKD Acquisition Time: 1.98 Days
Sample Mass: 0.068600 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 836.21 KeV
Gamma Ray Energy: 510.20 512.17 KeV
SLOPE: 1.001808 INTERCEPT: -2.896057

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
53.165	6.429	242	2.360	0.3688	0.085056	27.74283	31.9	23.80	TA179
121.248	2.107	254	0.684	0.6618	0.093383	7.32066	10.3	31.46	CO57
138.730	1.707	98	2.110	0.7049	0.091853	22.96719	32.2	130.91	CO57 *
184.442	1.206	128	1.473	0.7648	0.082586	17.83317	20.4	47.23	HF/LU
333.832	0.796	70	0.322	0.8206	0.054072	5.94624	0.543E+19	60.91	CD115
695.074	0.558	-261	-8.807	0.8548	0.026556	-331.62697	0.000E+00	37.94	HF/LU*
834.826	0.511	642	1.478	0.8614	0.022061	66.98420	90.0	9.03	MN54
847.158	0.507	72	0.166	0.8620	0.021739	7.62908	25.0	48.80	CO56 *
1118.518	0.442	16	0.037	0.8715	0.016613	2.21657	6.66	282.33	SC46 *
1174.359	0.432	73	0.168	0.8732	0.015886	10.58480	11.1	48.98	CO60 *
1334.919	0.405	-26	-0.060	0.8773	0.014190	-4.21719	0.000E+00	121.70	CO60 *

LDEF RUN NO. 140
Energy Calibration: Calibration Spectrum
Spectrum Name: LHGSP5.PKD Acquisition Time: 2.00 Days
Sample Mass: 0.075000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 838.89 KeV
Gamma Ray Energy: 510.20 514.73 KeV
SLOPE: 1.001437 INTERCEPT: -5.269897

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
120.581	2.127	229	0.559	0.6189	0.087606	6.37574	10.8	34.08	CO57
137.635	1.727	272	5.306	0.6649	0.087070	60.94213	103.	32.33	CO57
157.173	1.442	99	0.209	0.7010	0.084433	2.47491	0.426E+11	88.69	56NI
834.826	0.511	686	1.431	0.8420	0.021564	66.35946	105.	9.04	MN54
847.023	0.507	84	0.175	0.8427	0.021257	8.24918	52.5	49.07	CO56 *
1122.018	0.442	-17	-0.035	0.8543	0.016236	-2.18390	0.000E+00	249.15	SC46 *
1174.994	0.432	54	0.113	0.8561	0.015567	7.24119	7.80	59.27	CO60 *
1335.064	0.405	12	0.025	0.8607	0.013920	1.79813	1.94	340.77	CO60 *

LDEF RUN NO. 141
Energy Calibration: Calibration Spectrum
Spectrum Name: LGSP5D.PKD Acquisition Time: 2.67 Days
Sample Mass: 0.075000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.02 KeV
Gamma Ray Energy: 511.00 510.20 KeV
SLOPE: 1.000018 INTERCEPT: 0.790588

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.743	2.038	389	0.712	0.6288	0.087685	8.11541	13.9	23.55	CO57
479.979	0.666	82	1.234	0.8153	0.037438	32.97183	506.	54.04	BE7
659.243	0.573	167	0.276	0.8308	0.027303	10.11279	18.1	29.72	AG110
834.826	0.511	800	1.252	0.8420	0.021564	58.04035	92.5	8.63	MN54
845.466	0.508	1	0.002	0.8426	0.021295	0.07352	0.478	3895.00	CO56 *
1120.511	0.442	-48	-0.075	0.8543	0.016256	-4.61901	0.000E+00	110.87	SC46 *
1173.042	0.432	15	0.023	0.8560	0.015591	1.50631	1.62	253.44	CO60 *
1333.475	0.405	-70	-0.110	0.8607	0.013934	-7.85876	0.000E+00	69.65	CO60 *

LDEF RUN NO. 143
Energy Calibration: Calibration Spectrum
Spectrum Name: LGSP61.PKD Acquisition Time: 1.71 Days
Sample Mass: 0.073000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 509.61 KeV
Gamma Ray Energy: 834.83 834.60 KeV
SLOPE: 0.998880 INTERCEPT: 1.160828

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.636	2.096	323	0.947	0.5735	0.080767	11.72854	20.3	25.99	CO57
475.149	0.669	98	2.365	0.7851	0.036431	64.92082	0.106E+04	37.38	BE7
834.826	0.511	492	1.234	0.8149	0.020869	59.13146	95.2	10.49	MN54
847.182	0.507	14	0.035	0.8156	0.020569	1.70838	11.6	234.68	CO56 *
1173.356	0.432	37	0.093	0.8306	0.015123	6.14084	6.63	74.80	CO60 *
1332.288	0.405	-31	-0.078	0.8360	0.013546	-5.73950	0.000E+00	114.26	CO60 *

LDEF RUN NO. 152
Energy Calibration: Calibration Spectrum
Spectrum Name: LGSP62.PKD Acquisition Time: 2.67 Days
Sample Mass: 0.073000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 835.09 KeV
Gamma Ray Energy: 1332.50 1333.20 KeV
SLOPE: 0.999127 INTERCEPT: 0.465149

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.899	2.089	354	0.665	0.5744	0.080791	8.23502	14.3	27.31	CO57
318.108	0.817	81	1.324	0.7580	0.052254	25.33978	0.577E+04	71.48	CR51
333.574	0.796	77	0.247	0.7617	0.050226	4.91716	0.980E+30	72.82	CD115
338.010	0.791	46	0.148	0.7627	0.049668	2.97055	0.592E+30	94.24	CD115
834.826	0.511	729	1.172	0.8149	0.020869	56.14808	90.9	9.11	MN54
845.936	0.508	107	0.172	0.8155	0.020599	8.35528	57.9	42.06	CO56 *
1120.327	0.442	37	0.059	0.8285	0.015768	3.77112	22.7	153.34	SC46 *
1172.831	0.432	37	0.060	0.8305	0.015130	3.93372	4.25	104.25	CO60 *
1221.059	0.423	81	0.482	0.8323	0.014599	33.02168	123.	30.05	TA182
1237.254	0.421	12	0.029	0.8329	0.014432	1.99427	13.8	313.43	CO56 *
1332.501	0.405	-31	-0.050	0.8360	0.013544	-3.67864	0.000E+00	165.04	CO60 *
2597.645	0.292	11	0.106	0.8596	0.008947	11.82998	81.9	6.07	CO56

LDEF RUN NO. 155
Energy Calibration: Calibration Spectrum
Spectrum Name: RLER61.PKD Acquisition Time: 2.11 Days
Sample Mass: 0.072300 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 520.41 KeV
Gamma Ray Energy: 834.83 845.45 KeV
SLOPE: 0.998726 INTERCEPT: -9.546997

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.084	2.056	336	0.805	0.5783	0.080894	9.95551	17.8	25.11	CO57
834.826	0.511	457	0.937	0.8149	0.020869	44.88847	74.4	10.68	MN54
846.211	0.508	71	0.146	0.8155	0.020592	7.07277	53.8	51.40	CO56 *
1040.863	0.459	54	0.785	0.8252	0.016876	46.50504	354.	52.15	CO56
1172.555	0.432	89	0.183	0.8305	0.015133	12.06454	13.1	41.26	CO60 *
1332.112	0.405	74	0.152	0.8360	0.013547	11.19612	12.2	63.27	CO60 *

LDEF RUN NO. 156
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLN61.PKD Acquisition Time: 2.24 Days
Sample Mass: 0.072300 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 835.32 KeV
Gamma Ray Energy: 1332.50 1332.87 KeV
SLOPE: 1.000251 INTERCEPT: -0.703857

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.207	2.108	262	0.592	0.5720	0.080725	7.33941	13.2	37.56	CO57
834.826	0.511	403	0.779	0.8149	0.020869	37.34659	62.2	13.14	MN54
846.159	0.508	85	0.165	0.8155	0.020594	7.98814	62.1	45.18	CO56 *
1118.677	0.442	67	0.130	0.8284	0.015789	8.20537	54.9	73.96	SC46 *
1172.861	0.432	27	0.052	0.8305	0.015129	3.45394	3.75	136.93	CO60 *
1332.501	0.405	-20	-0.039	0.8360	0.013544	-2.85558	0.000E+00	219.63	CO60 *
1809.531	0.348	21	0.041	0.8480	0.010755	3.78443	0.000E+00	77.29	AL26

LDEF RUN NO. 157
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLS61.PKD Acquisition Time: 2.67 Days
Sample Mass: 0.072300 Kilograms. Material : STEEL
Gamma Ray Energy: 122.06 123.02 KeV
Gamma Ray Energy: 834.83 835.53 KeV
SLOPE: 1.000358 INTERCEPT: -1.003021

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.084	310	0.588	0.5749	0.080806	7.27999	13.2	35.49	CO57
137.897	1.722	465	7.058	0.6203	0.081136	86.98371	158.	40.61	CO57 *
322.853	0.810	96	1.585	0.7592	0.051619	30.69652	0.104E+05	87.63	CR51
811.588	0.518	155	0.253	0.8135	0.021458	11.77874	115.	24.22	CO58
834.826	0.511	583	0.946	0.8149	0.020869	45.33780	76.0	9.80	MN54
846.160	0.508	88	0.143	0.8155	0.020594	6.93996	55.4	49.32	CO56 *
1119.498	0.442	40	0.065	0.8285	0.015779	4.11360	28.2	143.27	SC46 *
1172.977	0.432	45	0.073	0.8305	0.015128	4.83106	5.25	92.80	CO60 *
1332.814	0.405	4	0.006	0.8361	0.013541	0.47935	0.521	1282.43	CO60 *

LDEF RUN NO. 158
Energy Calibration: Calibration Spectrum
Spectrum Name: rlsp61.pkd Acquisition Time: 2.10 Days
Sample Mass: 0.072700 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 834.80 KeV
Gamma Ray Energy: 1332.50 1332.20 KeV
SLOPE: 1.000553 INTERCEPT: -0.435547

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.742	2.093	190	0.454	0.5738	0.080776	5.62566	10.3	47.10	CO57
138.191	1.716	14	0.268	0.6211	0.081124	3.30118	6.02	1017.24	CO57 *
317.950	0.817	181	3.765	0.7580	0.052275	72.02755	0.260E+05	36.45	CR51
834.826	0.511	449	0.918	0.8149	0.020869	44.00791	74.2	10.78	MN54
846.803	0.507	87	0.178	0.8156	0.020578	8.65399	70.7	41.46	CO56 *
1120.164	0.442	115	0.235	0.8285	0.015770	14.91381	104.	42.23	SC46 *
1173.373	0.432	30	0.061	0.8306	0.015123	4.06050	4.42	113.94	CO60 *
1331.500	0.405	19	0.039	0.8360	0.013553	2.86733	3.12	226.20	CO60 *

LDEF RUN NO. 160
Energy Calibration: Calibration Spectrum
Spectrum Name: LLSP61.PKD Acquisition Time: 4.46 Days
Sample Mass: 0.072100 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 511.84 KeV
Gamma Ray Energy: 834.83 837.07 KeV
SLOPE: 0.995683 INTERCEPT: 1.369598

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
124.267	2.024	418	0.476	0.5821	0.080984	5.87588	10.9	28.51	CO57
322.049	0.811	350	3.466	0.7590	0.051725	66.99944	0.284E+05	26.77	CR51
834.826	0.511	1281	1.247	0.8149	0.020869	59.76181	102.	7.91	MN54
847.501	0.507	358	0.349	0.8156	0.020562	16.96351	147.	20.59	CO56 *
1238.466	0.420	17	0.025	0.8329	0.014419	1.71275	14.8	280.46	CO56 *
1331.005	0.405	12	0.012	0.8360	0.013557	0.86171	0.940	662.53	CO60 *

LDEF RUN NO. 161
Energy Calibration: Calibration Spectrum
Spectrum Name: LLER61.PKD Acquisition Time: 2.05 Days
Sample Mass: 0.072500 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 506.73 KeV
Gamma Ray Energy: 834.83 829.71 KeV
SLOPE: 1.002619 INTERCEPT: 2.942719

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
56.432	6.078	268	2.390	0.2924	0.064440	37.09126	48.4	21.77	TA179
124.961	2.005	266	0.655	0.5844	0.081030	8.08119	15.3	32.05	CO57
834.826	0.511	458	0.964	0.8149	0.020869	46.20456	80.6	9.95	MN54
1120.322	0.442	16	0.034	0.8285	0.015768	2.13601	17.0	271.99	SC46 *
1172.237	0.432	45	0.095	0.8305	0.015136	6.26367	6.86	75.83	CO60 *
1186.956	0.430	46	0.598	0.8311	0.014969	39.92596	182.	39.70	TA182
1236.235	0.421	73	0.229	0.8328	0.014442	15.87913	148.	36.04	CO56 *

LDEF RUN NO. 162
Energy Calibration: Calibration Spectrum
Spectrum Name: LHLN61.PKD Acquisition Time: 3.00 Days
Sample Mass: 0.072100 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 509.64 KeV
Gamma Ray Energy: 834.83 833.81 KeV
SLOPE: 0.998939 INTERCEPT: 1.900787

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.532	2.043	349	0.590	0.5798	0.080929	7.29430	13.9	27.93	CO57
318.465	0.816	130	1.913	0.7581	0.052206	36.63506	0.206E+05	53.23	CR51
834.826	0.511	772	1.117	0.8149	0.020869	53.51305	93.9	8.49	MN54
846.953	0.507	148	0.214	0.8156	0.020575	10.41339	99.6	31.68	CO56 *
1118.355	0.443	96	0.139	0.8284	0.015793	8.79182	71.3	64.82	SC46 *
1172.248	0.432	27	0.039	0.8305	0.015136	2.58233	2.83	159.35	CO60 *

LDEF RUN NO. 163
Energy Calibration: Calibration Spectrum
Spectrum Name: LHLS61.PKD Acquisition Time: 2.64 Days
Sample Mass: 0.072300 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 510.93 KeV
Gamma Ray Energy: 834.83 835.29 KeV
SLOPE: 0.998354 INTERCEPT: 0.911133

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.549	2.043	293	0.562	0.5798	0.080931	6.93961	13.3	30.95	CO57
834.826	0.511	558	0.915	0.8149	0.020869	43.83273	77.4	9.51	MN54
846.986	0.507	13	0.021	0.8156	0.020574	1.03660	10.2	294.45	CO56 *
1172.280	0.432	38	0.062	0.8305	0.015136	4.11864	4.52	103.77	CO60 *
1236.633	0.421	31	0.076	0.8329	0.014438	5.25211	51.6	101.91	CO56 *
1331.188	0.405	-59	-0.097	0.8360	0.013555	-7.13461	0.000E+00	81.52	CO60 *

LDEF RUN NO. 164
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLS51.PKD Acquisition Time: 6.26 Days
Sample Mass: 0.074400 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 511.59 KeV
Gamma Ray Energy: 834.83 836.17 KeV
SLOPE: 0.997677 INTERCEPT: 0.598419

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
56.428	6.079	746	2.125	0.3400	0.074922	28.35941	37.4	16.21	TA179
123.802	2.036	621	0.488	0.6290	0.087686	5.56764	10.8	22.86	CO57
834.826	0.511	1543	1.037	0.8420	0.021564	48.10924	85.8	7.71	MN54
846.349	0.508	21	0.014	0.8426	0.021273	0.66419	6.78	365.36	CO56 *
911.258	0.490	-271	-1.231	0.8459	0.019784	-62.21040	0.000E+00	45.91	HF/LU*
1119.194	0.442	26	0.017	0.8542	0.016273	1.07406	9.26	429.84	SC46 *

LDEF RUN NO. 165
Energy Calibration: Calibration Spectrum
Spectrum Name: rhls41.pkd Acquisition Time: 3.00 Days
Sample Mass: 0.066400 Kilograms. Material : STEEL
Gamma Ray Energy: 510.00 510.00 KeV
Gamma Ray Energy: 1132.00 1132.00 KeV
SLOPE: 1.000000 INTERCEPT: 0.000000

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.000	2.086	157	0.288	0.6641	0.093365	3.08849	6.07	68.26	CO57
847.000	0.507	39	0.061	0.8619	0.021744	2.81941	30.0	108.54	CO56 *
834.000	0.511	641	1.007	0.8614	0.022083	45.59388	82.1	9.21	MN54

LDEF RUN NO. 166
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLS31.PKD Acquisition Time: 2.71 Days
Sample Mass: 0.051300 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 509.30 KeV
Gamma Ray Energy: 834.83 833.19 KeV
SLOPE: 0.999802 INTERCEPT: 1.800690

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
834.826	0.511	520	1.172	0.8977	0.022989	50.98728	92.9	10.79	MN54
845.374	0.508	78	0.176	0.8981	0.022700	7.75142	86.2	61.95	CO56 *

LDEF RUN NO. 167
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLS21.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.032200 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 511.09 KeV
Gamma Ray Energy: 1173.27 1172.15 KeV
SLOPE: 1.001830 INTERCEPT: -1.025452

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.292	2.050	456	1.295	0.8329	0.116402	11.12777	22.4	26.22	CO57
809.906	0.518	87	0.212	0.9347	0.024708	8.59479	125.	39.97	CO58
835.493	0.511	630	1.530	0.9352	0.023931	63.95279	117.	11.20	MN54
847.054	0.507	101	0.246	0.9355	0.023597	10.40563	119.	66.85	CO56 *

LDEF RUN NO. 168
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLN21.PKD Acquisition Time: 4.04 Days
Sample Mass: 0.032100 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 511.84 KeV
Gamma Ray Energy: 834.83 836.53 KeV
SLOPE: 0.997339 INTERCEPT: 0.522064

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
123.943	2.032	444	1.254	0.8340	0.116199	10.79048	22.0	30.83	CO57
480.152	0.666	115	2.672	0.9244	0.042435	62.97806	0.238E+04	49.82	BE7
834.826	0.511	449	1.084	0.9352	0.023951	45.27598	84.2	14.12	MN54

LDEF RUN NO. 169
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLN31.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.051200 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 512.32 KeV
Gamma Ray Energy: 1332.50 1332.37 KeV
SLOPE: 1.001769 INTERCEPT: -2.226501

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.684	2.067	538	0.961	0.7421	0.104004	9.23837	19.1	25.42	CO57
835.643	0.511	506	0.773	0.8977	0.022967	33.65042	63.3	14.63	MN54
847.034	0.507	38	0.058	0.8981	0.022655	2.56380	32.4	153.93	CO56 *
1120.697	0.442	80	0.122	0.9058	0.017233	7.08956	74.4	95.83	SC46 *
1238.295	0.420	34	0.077	0.9082	0.015725	4.92781	62.3	126.44	CO56 *
2599.308	0.292	51	0.466	0.9229	0.009604	48.55477	614.	34.01	CO56

LDEF RUN NO. 170
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLN41.PKD Acquisition Time: 3.27 Days
Sample Mass: 0.066000 Kilograms. Material : STEEL
Gamma Ray Energy: 834.83 835.63 KeV
Gamma Ray Energy: 1332.50 1331.07 KeV
SLOPE: 1.004511 INTERCEPT: -4.573730

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
53.577	6.384	433	2.657	0.3707	0.084982	31.25988	42.4	19.29	TA179
121.502	2.100	260	0.440	0.6626	0.093378	4.71519	9.83	38.75	CO57
810.125	0.518	51	0.074	0.8604	0.022737	3.26401	54.5	62.99	CO58
834.826	0.511	681	0.986	0.8614	0.022061	44.70626	84.8	9.88	MN54
847.121	0.507	143	0.207	0.8619	0.021740	9.53324	125.	39.78	CO56 *
890.607	0.495	75	0.109	0.8637	0.020684	5.25096	56.9	38.80	SC46
1034.905	0.460	73	0.750	0.8689	0.017872	41.94407	548.	42.25	CO56
1120.429	0.442	102	0.148	0.8716	0.016587	8.90505	96.4	61.66	SC46 *
1172.754	0.432	47	0.068	0.8731	0.015906	4.28252	4.75	98.79	CO60 *
1237.374	0.421	99	0.214	0.8749	0.015158	14.11404	184.	39.31	CO56 *

LDEF RUN NO. 171
Energy Calibration: Calibration Spectrum
Spectrum Name: RHLN51.PKD Acquisition Time: 3.24 Days
Sample Mass: 0.074500 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 509.49 KeV
Gamma Ray Energy: 834.83 833.28 KeV
SLOPE: 1.000111 INTERCEPT: 1.453461

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
124.757	2.011	339	0.514	0.6318	0.087692	5.86626	12.4	37.39	CO57
136.718	1.744	144	1.748	0.6629	0.087151	20.05393	42.2	67.59	CO57
834.826	0.511	641	0.832	0.8420	0.021564	38.57725	73.8	9.78	MN54
847.447	0.507	36	0.047	0.8427	0.021246	2.20063	29.8	123.51	CO56 *
1119.088	0.442	21	0.027	0.8542	0.016275	1.67437	18.7	304.96	SC46 *
1172.023	0.432	49	0.064	0.8560	0.015603	4.07862	4.53	87.14	CO60 *
1236.901	0.421	45	0.087	0.8580	0.014870	5.86017	79.3	81.33	CO56 *

TABLE OF BACKGROUND GAMMA RAY ENERGIES TO BE SUBTRACTED

KeV	NET AREA	%ERROR	LIVE TIME	SOURCE
86.510	777	26.380	342665.0	BG175inc
112.150	1054	29.790	342665.0	BG175inc
140.660	600	39.330	342665.0	BG175inc
198.400	735	29.250	342665.0	BG175inc
238.700	551	39.380	342665.0	BG175inc
278.000	152	40.000	342665.0	BG175inc
294.980	507	34.910	342665.0	BG175inc
351.630	222	25.000	342665.0	BG175inc
389.700	200	50.000	342665.0	BG175inc
511.000	7066	2.250	342665.0	BG175inc
583.250	207	25.150	342665.0	BG175inc
596.480	155	51.610	342665.0	BG175inc
608.920	323	28.170	342665.0	BG175inc
661.600	95	45.000	342665.0	BG175inc
696.070	689	24.240	342665.0	BG175inc
803.790	226	33.000	342665.0	BG175inc
847.800	202	24.000	342665.0	BG175inc
960.910	272	38.970	342665.0	BG175inc
1120.260	65	55.400	342665.0	BG175inc
1173.070	243	23.460	342665.0	BG175inc
1197.870	307	29.640	342665.0	BG175inc
1239.150	156	38.460	342665.0	BG175inc
1332.100	326	23.930	342665.0	BG175inc
1460.800	644	8.700	342665.0	BG175inc
1764.720	140	37.860	342665.0	BG175inc
1794.530	94	43.620	342665.0	BG175inc
2223.610	67	34.330	342665.0	BG175inc
2614.260	122	27.870	342665.0	BG175inc

* INDICATES BACKGROUND SUBTRACTED USING BG175inc

LDEF RUN NO. 176
Energy Calibration: Calibration Spectrum
Spectrum Name: RLER21.PKD Acquisition Time: 2.96 Days
Sample Mass: 0.032100 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 512.30 KeV
Gamma Ray Energy: 834.83 835.82 KeV
SLOPE: 1.003419 INTERCEPT: -3.851318

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.519	2.071	232	0.894	0.8316	0.116641	7.66035	16.9	50.40	CO57
155.843	1.457	144	0.480	0.8703	0.105405	4.55326	0.818E+16	55.11	56NI
159.244	1.419	78	0.260	0.8728	0.104229	2.49418	0.448E+16	12.91	56NI
834.826	0.511	521	1.716	0.9352	0.023951	71.64917	142.	10.41	MN54
845.864	0.508	20	0.066	0.9354	0.023631	2.78974	44.0	278.04	CO56 *
1172.657	0.432	18	0.059	0.9410	0.017144	3.46079	3.87	294.65	CO60 *
1330.746	0.406	11	0.036	0.9430	0.015294	2.36875	2.65	617.04	CO60 *

LDEF RUN NO. 177
Energy Calibration: Calibration Spectrum
Spectrum Name: RLSP21.PKD Acquisition Time: 2.95 Days
Sample Mass: 0.032300 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 509.32 KeV
Gamma Ray Energy: 834.83 833.91 KeV
SLOPE: 1.000111 INTERCEPT: 0.823486

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.747	2.065	257	0.988	0.8320	0.116572	8.47354	18.8	36.14	CO57
133.558	1.806	366	11.251	0.8480	0.113073	99.50328	221.	26.85	CO57
137.039	1.738	104	3.197	0.8523	0.111898	28.57097	63.3	62.83	CO57
156.591	1.449	139	0.462	0.8709	0.105146	4.39700	0.111E+17	65.25	56NI
160.041	1.410	149	0.496	0.8734	0.103955	4.76735	0.120E+17	61.15	56NI
834.826	0.511	253	0.832	0.9352	0.023951	34.72222	69.4	17.20	MN54
846.547	0.507	59	0.194	0.9355	0.023611	8.21983	133.	86.23	CO56 *
1173.204	0.432	1	0.003	0.9410	0.017136	0.19196	0.215	5246.34	CO60 *
1236.371	0.421	-74	-0.363	0.9418	0.016330	-22.22581	0.000E+00	77.54	CO56 *
1332.781	0.405	-74	-0.243	0.9430	0.015274	-15.92430	0.000E+00	91.56	CO60 *

LDEF RUN NO. 178
Energy Calibration: Calibration Spectrum
Spectrum Name: LHLS21.PKD Acquisition Time: 3.98 Days
Sample Mass: 0.032100 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 510.85 KeV
Gamma Ray Energy: 834.83 835.88 KeV
SLOPE: 0.998757 INTERCEPT: -0.014984

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.493	2.072	320	0.917	0.8316	0.116651	7.85985	17.6	41.82	CO57
158.438	1.428	524	1.299	0.8722	0.104507	12.43218	0.466E+17	29.21	56NI
834.826	0.511	560	1.372	0.9352	0.023951	57.29272	115.	10.87	MN54
846.711	0.507	-20	-0.049	0.9355	0.023607	-2.07754	0.000E+00	318.60	CO56 *
1172.666	0.432	-5	-0.012	0.9410	0.017143	-0.71519	0.000E+00	1362.22	CO60 *
1331.458	0.405	-161	-0.394	0.9430	0.015287	-25.80478	0.000E+00	53.00	CO60 *

LDEF RUN NO. 179
Energy Calibration: Calibration Spectrum
Spectrum Name: LHLN21.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.031500 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 860.45 KeV
Gamma Ray Energy: 834.83 1331.32 KeV
SLOPE: 0.689417 INTERCEPT: -83.009277

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.120	2.082	445	1.292	0.8310	0.116765	11.06615	25.3	27.81	CO57
158.390	1.428	348	0.874	0.8722	0.104524	8.36607	0.783E+17	32.57	56NI
834.826	0.511	682	1.694	0.9352	0.023951	70.71186	145.	9.76	MN54
846.291	0.508	-14	-0.035	0.9355	0.023619	-1.47307	0.000E+00	491.44	CO56 *
1174.295	0.432	111	0.276	0.9410	0.017122	16.11121	18.1	65.91	CO60 *
1333.130	0.405	-82	-0.204	0.9430	0.015270	-13.33387	0.000E+00	104.67	CO60 *

LDEF RUN NO. 180
Energy Calibration: Calibration Spectrum
Spectrum Name: LLSP21.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.031300 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 860.55 KeV
Gamma Ray Energy: 834.83 1331.80 KeV
SLOPE: 0.688861 INTERCEPT: -82.599609

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.896	2.089	324	0.947	0.8306	0.116834	8.10384	18.8	31.74	CO57
834.826	0.511	719	1.797	0.9352	0.023951	75.02448	156.	9.91	MN54
846.544	0.507	-55	-0.138	0.9355	0.023611	-5.82585	0.000E+00	117.03	CO56 *
983.882	0.472	62	0.155	0.9381	0.020295	7.63358	0.123E+08	56.90	V48
1120.207	0.442	5	0.012	0.9402	0.017896	0.69815	10.6	968.21	SC46 *
1172.678	0.432	-87	-0.218	0.9410	0.017143	-12.69218	0.000E+00	80.96	CO60 *
1331.330	0.405	-217	-0.542	0.9430	0.015289	-35.46930	0.000E+00	39.29	CO60 *

LDEF RUN NO. 181
Energy Calibration: Calibration Spectrum
Spectrum Name: LLER21.PKD Acquisition Time: 3.74 Days
Sample Mass: 0.032000 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 511.54 KeV
Gamma Ray Energy: 834.83 836.01 KeV
SLOPE: 1.000481 INTERCEPT: -1.585876

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.823	2.091	569	1.737	0.8305	0.116856	14.86610	34.8	21.58	CO57
138.111	1.718	-209	-5.104	0.8536	0.111534	-45.75789	0.000E+00	122.05	CO57 *
158.881	1.423	387	1.022	0.8725	0.104355	9.79811	0.278E+18	37.11	56NI
834.826	0.511	498	1.300	0.9352	0.023951	54.29078	114.	12.35	MN54
846.382	0.508	26	0.068	0.9355	0.023616	2.87676	56.3	259.26	CO56 *
1173.129	0.432	136	0.355	0.9410	0.017137	20.73630	23.4	52.36	CO60 *
1331.115	0.405	-216	-0.564	0.9430	0.015290	-36.88212	0.000E+00	37.48	CO60 *

LDEF RUN NO. 182
Energy Calibration: Calibration Spectrum
Spectrum Name: LLER31.PKD Acquisition Time: 3.92 Days
Sample Mass: 0.051100 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 514.20 KeV
Gamma Ray Energy: 834.83 838.36 KeV
SLOPE: 1.001438 INTERCEPT: -4.739197

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.232	2.108	212	0.388	0.7385	0.104209	3.71909	9.03	64.87	CO57
137.795	1.724	-29	-0.424	0.7732	0.101169	-4.19127	0.000E+00	929.57	CO57 *
157.824	1.435	1079	1.707	0.8008	0.096196	17.74509	0.252E+19	20.33	56NI
834.826	0.511	674	1.054	0.8977	0.022989	45.83661	99.2	10.32	MN54
846.202	0.508	86	0.135	0.8981	0.022677	5.93350	132.	78.49	CO56 *
1172.931	0.432	-123	-0.192	0.9069	0.016519	-11.65000	0.000E+00	52.37	CO60 *
1333.432	0.405	-10	-0.016	0.9100	0.014732	-1.06116	0.000E+00	852.95	CO60 *
2596.184	0.292	62	0.580	0.9229	0.009608	60.39709	0.134E+04	30.05	CO56

LDEF RUN NO. 183
Energy Calibration: Calibration Spectrum
Spectrum Name: LLER41.PKD Acquisition Time: 3.52 Days
Sample Mass: 0.066500 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 514.70 KeV
Gamma Ray Energy: 834.83 839.29 KeV
SLOPE: 1.000111 INTERCEPT: -4.557129

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.867	2.090	454	0.709	0.6637	0.093368	7.59691	18.6	25.88	CO57
139.159	1.699	122	1.525	0.7057	0.091792	16.60827	40.7	197.27	CO57 *
834.826	0.511	883	1.180	0.8614	0.022061	53.48017	117.	8.72	MN54
846.757	0.507	108	0.144	0.8619	0.021750	6.63977	153.	58.00	CO56 *
1173.424	0.432	-5	-0.007	0.8731	0.015898	-0.42054	0.000E+00	1338.62	CO60 *
1332.041	0.405	-71	-0.095	0.8773	0.014216	-6.67269	0.000E+00	109.17	CO60 *

LDEF RUN NO. 186
Energy Calibration: Calibration Spectrum
Spectrum Name: LLER51.PKD Acquisition Time: 2.93 Days
Sample Mass: 0.074200 Kilograms. Material : STEEL
Gamma Ray Energy: 122.06 123.33 KeV
Gamma Ray Energy: 834.83 845.31 KeV
SLOPE: 0.987231 INTERCEPT: 0.309746

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.095	2.083	261	0.440	0.6237	0.087656	5.01885	12.5	36.07	CO57
139.243	1.698	-322	-4.341	0.6685	0.086915	-49.94522	0.000E+00	62.37	CO57 *
834.826	0.511	595	0.858	0.8420	0.021564	39.77522	88.1	11.72	MN54

LDEF RUN NO. 187
Energy Calibration: Calibration Spectrum
Spectrum Name: LLER52.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.074200 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 512.45 KeV
Gamma Ray Energy: 834.83 840.03 KeV
SLOPE: 0.990982 INTERCEPT: 2.371155

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
124.004	2.031	310	0.382	0.6296	0.087688	4.35787	11.0	39.49	CO57
161.117	1.399	348	0.371	0.7067	0.083750	4.43257	0.306E+19	39.70	56NI
834.826	0.511	1196	1.261	0.8420	0.021564	58.47056	130.	8.80	MN54

LDEF RUN NO. 188
Energy Calibration: Calibration Spectrum
Spectrum Name: LLSP51.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.074100 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 513.51 KeV
Gamma Ray Energy: 834.83 839.31 KeV
SLOPE: 0.996397 INTERCEPT: -1.459595

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
121.974	2.087	419	0.517	0.6234	0.087653	5.90051	15.0	29.50	CO57
139.431	1.694	-203	-2.004	0.6689	0.086896	-23.06342	0.000E+00	126.39	CO57 *
159.957	1.411	132	0.141	0.7051	0.083955	1.67949	0.184E+19	70.90	56NI
813.583	0.517	23	0.024	0.8409	0.022122	1.10278	39.3	5.94	CO58
834.826	0.511	849	0.896	0.8420	0.021564	41.56229	93.6	9.13	MN54
847.042	0.507	17	0.018	0.8427	0.021256	0.84489	22.0	365.32	CO56 *
985.651	0.471	70	0.074	0.8492	0.018338	4.02894	0.312E+08	60.80	V48
1173.362	0.432	44	0.046	0.8560	0.015587	2.98216	3.40	156.71	CO60 *
1331.789	0.405	-176	-0.186	0.8606	0.013949	-13.31868	0.000E+00	48.33	CO60 *

LDEF RUN NO. 189
Energy Calibration: Calibration Spectrum
Spectrum Name: LLSP31.PKD Acquisition Time: 3.96 Days
Sample Mass: 0.050500 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 514.29 KeV
Gamma Ray Energy: 834.83 839.64 KeV
SLOPE: 0.997775 INTERCEPT: -2.945435

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.644	2.068	707	1.295	0.7420	0.104010	12.44859	32.0	19.40	CO57
834.826	0.511	625	0.979	0.8977	0.022989	42.57967	96.9	9.89	MN54
846.909	0.507	32	0.050	0.8981	0.022659	2.21356	60.3	198.72	CO56 *
1172.622	0.432	201	0.315	0.9069	0.016523	19.06706	21.8	33.97	CO60 *
1237.777	0.421	-88	-0.206	0.9082	0.015730	-13.07406	0.000E+00	76.49	CO56 *
1332.157	0.405	-87	-0.136	0.9099	0.014744	-9.24104	0.000E+00	97.57	CO60 *

LDEF RUN NO. 190
Energy Calibration: Calibration Spectrum
Spectrum Name: LLSP41.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.066000 Kilograms. Material : STEEL
Gamma Ray Energy: 511.00 515.10 KeV
Gamma Ray Energy: 834.83 841.61 KeV
SLOPE: 0.991780 INTERCEPT: 0.134308

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
124.523	2.017	197	0.273	0.6712	0.093267	2.92720	7.60	48.41	CO57
160.386	1.406	137	0.164	0.7399	0.087944	1.86826	0.541E+19	68.19	56NI
812.174	0.518	99	0.118	0.8605	0.022679	5.19839	201.	38.76	CO58
834.826	0.511	764	0.905	0.8614	0.022061	41.04485	94.2	10.39	MN54
845.418	0.508	11	0.013	0.8619	0.021784	0.59891	16.9	621.52	CO56 *
1329.744	0.406	-213	-0.252	0.8772	0.014237	-17.73031	0.000E+00	40.45	CO60 *

LDEF RUN NO. 191
Energy Calibration: Calibration Spectrum
Spectrum Name: LHLN41.PKD Acquisition Time: 4.00 Days
Sample Mass: 0.066600 Kilograms. Material : STEEL
Gamma Ray Energy: 510.20 515.33 KeV
Gamma Ray Energy: 834.83 840.84 KeV
SLOPE: 0.997284 INTERCEPT: -3.730469

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.276	2.078	500	0.687	0.6649	0.093356	7.35548	19.4	25.96	CO57
133.984	1.797	152	1.670	0.6948	0.092467	18.05632	47.6	65.06	CO57
139.130	1.700	-104	-1.142	0.7057	0.091797	-12.44455	0.000E+00	256.57	CO57 *
158.907	1.422	240	0.285	0.7380	0.088251	3.23209	0.176E+20	50.44	56NI
834.826	0.511	1025	1.204	0.8614	0.022061	54.57061	127.	8.65	MN54
846.863	0.507	63	0.074	0.8619	0.021747	3.40505	101.	108.82	CO56 *
1172.526	0.432	-51	-0.060	0.8731	0.015909	-3.76805	0.000E+00	139.22	CO60 *
1240.023	0.420	-109	-0.191	0.8750	0.015129	-12.62650	0.000E+00	60.37	CO56 *
1332.580	0.405	-81	-0.095	0.8773	0.014211	-6.69395	0.000E+00	109.24	CO60 *

Appendix C

Results of the Analysis of Intentional Samples

This appendix contains the results of the analysis of the gamma-ray spectra taken of the samples of vanadium, nickel, cobalt, indium and tantalum intentionally placed at various locations aboard LDEF. The heading of each table gives pertinent information about the run, or spectrum, number including the spectrum name, the mass of the sample, the acquisition time and the correction to the energy calibration taken from the MSFC spectra and the MSFC data book. The column header gives the gamma-ray energy, the peak area, the efficiency (EFFATN) correction, the corrected efficiency, the activated in pCi/kg (PC/Kg) and that specific activity corrected to January 20, 1990, the propagated error, and the identity of the radioisotope. The error contains the statistical error in the peak area including the error in the background subtraction, the error in the calibration source, and the estimated error in the EFFATN correction. As indicated the asterisk (*) indicates the source of the background subtracted. Before run 172 the subtracted background comes from that spectrum. After run 175 the background comes from run 175. Some spectra were analyzed with no background subtraction and in some cases the spectra were analyzed with several of the peak analysis programs. These latter can be used to judge the effects of the different analyses.

* INDICATES BACKGROUND SUBTRACTED USING BG172inc

LDEF RUN NO. 26
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9V.PCA Acquisition Time: 1.00 Days
Sample Mass: 0.053000 Kilograms. Material : VANADIUM
Gamma Ray Energy: 295.94 295.35 KeV
Gamma Ray Energy: 1120.27 1120.77 KeV
SLOPE: 0.998684 INTERCEPT: 0.977600

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
846.534	0.385	36	0.213	0.9060	0.022869	9.30032	15.3	119.18	CO56 *
888.518	0.376	49	0.289	0.9074	0.021783	13.27888	21.1	57.45	SC46
1037.262	0.349	41	1.716	0.9116	0.018708	91.73755	151.	53.99	CO56
1120.273	0.336	44	0.260	0.9136	0.017388	14.93685	23.8	87.66	SC46 *
1172.744	0.328	35	0.207	0.9147	0.016665	12.40842	12.7	108.57	CO60 *
1237.798	0.319	20	0.176	0.9161	0.015866	11.10409	18.3	110.22	CO56 *
1332.413	0.308	37	0.218	0.9178	0.014870	14.68889	15.0	81.68	CO60 *

LDEF RUN NO. 26
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9V.PCA Acquisition Time: 1.00 Days
Sample Mass: 0.053000 Kilograms. Material : VANADIUM
Gamma Ray Energy: 295.94 295.35 KeV
Gamma Ray Energy: 1120.27 1120.77 KeV
SLOPE: 0.998684 INTERCEPT: 0.977600

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
846.534	0.385	70	0.414	0.9024	0.022776	18.15788	29.9	60.29	CO56
888.518	0.376	49	0.289	0.9038	0.021695	13.33231	21.2	57.45	SC46
1037.262	0.349	41	1.716	0.9082	0.018637	92.08569	152.	53.99	CO56
1120.273	0.336	94	0.555	0.9103	0.017325	32.02765	50.9	37.70	SC46
1172.744	0.328	95	0.561	0.9115	0.016605	33.80099	34.5	39.40	CO60
1237.798	0.319	42	0.370	0.9129	0.015811	23.40017	38.6	50.35	CO56
1332.413	0.308	98	0.579	0.9148	0.014820	39.03671	39.8	27.19	CO60

LDEF RUN NO. 27
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9CO.PCA Acquisition Time: 1.00 Days
Sample Mass: 0.068200 Kilograms. Material : COBALT
Gamma Ray Energy: 122.06 122.03 KeV
Gamma Ray Energy: 834.83 835.11 KeV
SLOPE: 0.999558 INTERCEPT: 0.084900

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.499	3535	18.964	0.6469	0.090928	208.55790	241.	7.12	CO57
136.585	2.082	428	18.364	0.6891	0.090656	202.56741	234.	25.24	CO57
810.727	0.579	274	1.263	0.8749	0.023103	54.67135	95.5	16.44	CO58
834.826	0.571	479	2.198	0.8761	0.022435	97.95200	111.	10.94	MN54
846.511	0.567	59	0.271	0.8766	0.022126	12.24282	20.4	49.96	CO56 *
982.721	0.527	58	0.266	0.8822	0.019108	13.92358	166.	57.54	V48
1120.240	0.494	33	0.151	0.8869	0.016881	8.96770	14.4	105.88	SC46 *
1173.177	0.482	120	0.551	0.8886	0.016182	34.04726	34.8	25.08	CO60 *
1238.008	0.470	34	0.233	0.8905	0.015421	15.09346	25.1	102.03	CO56 *
1332.076	0.453	85	0.390	0.8931	0.014472	26.94514	27.5	33.98	CO60 *

LDEF RUN NO. 27
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9CO.PCA Acquisition Time: 1.00 Days
Sample Mass: 0.068200 Kilograms. Material : COBALT
Gamma Ray Energy: 122.06 122.03 KeV
Gamma Ray Energy: 834.83 835.11 KeV
SLOPE: 0.999558 INTERCEPT: 0.084900

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.499	3535	18.964	0.6801	0.095595	198.37564	229.	7.12	CO57
136.585	2.082	428	18.364	0.7190	0.094581	194.16055	225.	25.24	CO57
810.727	0.579	274	1.263	0.8897	0.023493	53.76265	93.9	16.44	CO58
834.826	0.571	479	2.198	0.8908	0.022812	96.33414	109.	10.94	MN54
846.511	0.567	93	0.427	0.8913	0.022497	18.98018	31.6	30.69	CO56
982.721	0.527	58	0.266	0.8965	0.019418	13.70127	163.	57.54	V48
1120.240	0.494	83	0.381	0.9008	0.017145	22.20677	35.6	37.82	SC46
1173.177	0.482	180	0.826	0.9023	0.016432	50.29320	51.3	16.65	CO60
1238.008	0.470	56	0.383	0.9040	0.015655	24.48798	40.8	61.00	CO56
1332.076	0.453	146	0.670	0.9063	0.014686	45.60796	46.6	17.48	CO60

LDEF RUN NO. 28
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9IN.PCA Acquisition Time: 1.26 Days
Sample Mass: 0.061800 Kilograms. Material : INDIUM
Gamma Ray Energy: 569.15 569.93 KeV
Gamma Ray Energy: 1332.51 1332.69 KeV
SLOPE: 1.000787 INTERCEPT: -1.228333

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
390.810	0.837	109	0.683	0.8292	0.046908	14.56642	20.7	53.41	SN113*
845.677	0.465	35	0.141	0.8799	0.022231	6.32251	10.6	121.24	CO56 *
1119.833	0.396	-17	-0.068	0.8893	0.016932	-4.02862	0.000E+00	207.84	SC46 *
1173.385	0.386	-9	-0.036	0.8906	0.016217	-2.22875	0.000E+00	417.14	CO60 *
1238.026	0.375	24	0.144	0.8922	0.015450	9.30183	15.7	158.19	CO56 *
1314.706	0.364	35	0.144	0.8938	0.014655	9.82847	123.	65.98	V48
1332.510	0.361	-21	-0.084	0.8942	0.014485	-5.81731	0.000E+00	128.94	CO60 *

LDEF RUN NO. 28
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9IN.PCA Acquisition Time: 1.26 Days
Sample Mass: 0.061800 Kilograms. Material : INDIUM
Gamma Ray Energy: 569.15 569.93 KeV
Gamma Ray Energy: 1332.51 1332.69 KeV
SLOPE: 1.000787 INTERCEPT: -1.228333

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
390.810	0.837	139	0.871	0.8420	0.047631	18.29364	26.0	41.44	SN113
845.677	0.465	78	0.313	0.8941	0.022592	13.86555	23.3	52.90	CO56
1119.833	0.396	46	0.185	0.9044	0.017219	10.71917	17.4	63.32	SC46
1173.385	0.386	67	0.269	0.9059	0.016494	16.31321	16.7	54.06	CO60
1238.026	0.375	52	0.311	0.9075	0.015716	19.81307	33.3	71.40	CO56
1314.706	0.364	35	0.144	0.9093	0.014909	9.66101	121.	65.98	V48
1332.510	0.361	56	0.225	0.9097	0.014737	15.24812	15.6	34.45	CO60

LDEF RUN NO. 29
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9IN2.PCA Acquisition Time: 0.59 Days
Sample Mass: 0.061800 Kilograms. Material : INDIUM
Gamma Ray Energy: 569.15 569.89 KeV
Gamma Ray Energy: 1332.51 1332.26 KeV
SLOPE: 1.001299 INTERCEPT: -1.480042

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.130	8.042	141	1.411	0.3350	0.047075	29.98262	34.9	38.16	CO57
133.926	6.280	62	4.964	0.4028	0.053615	92.58323	108.	31.64	CO57
390.709	0.837	104	1.391	0.8291	0.046918	29.64268	42.3	46.75	SN113*
847.251	0.464	19	0.163	0.8799	0.022191	7.33544	12.4	103.58	CO56 *
1120.505	0.396	29	0.248	0.8893	0.016922	14.66895	23.9	85.74	SC46 *
1173.564	0.386	4	0.034	0.8906	0.016215	2.11342	2.16	442.34	CO60 *
1332.510	0.361	18	0.154	0.8942	0.014485	10.63717	10.9	163.50	CO60 *

LDEF RUN NO. 29
Energy Calibration: Calibration Spectrum
Spectrum Name: IC9IN2.PCA Acquisition Time: 0.59 Days
Sample Mass: 0.061800 Kilograms. Material : INDIUM
Gamma Ray Energy: 569.15 569.89 KeV
Gamma Ray Energy: 1332.51 1332.26 KeV
SLOPE: 1.001299 INTERCEPT: -1.480042

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.130	8.042	141	1.411	0.3351	0.047086	29.97542	34.8	38.16	CO57
133.926	6.280	62	4.964	0.4035	0.053709	92.42213	107.	31.64	CO57
390.709	0.837	118	1.578	0.8419	0.047641	33.12269	47.3	41.11	SN113
847.251	0.464	39	0.334	0.8942	0.022550	14.81685	25.1	49.08	CO56
1120.505	0.396	58	0.496	0.9044	0.017209	28.84857	47.0	40.10	SC46
1173.564	0.386	39	0.334	0.9059	0.016492	20.25982	20.7	43.99	CO60
1332.510	0.361	54	0.462	0.9097	0.014737	31.36696	32.0	52.19	CO60

* INDICATES BACKGROUND SUBTRACTED USING BG172

LDEF RUN NO. 62
Energy Calibration: Calibration Spectrum
Spectrum Name: TAC31.sho Acquisition Time: 0.98 Days
Sample Mass: 0.136000 Kilograms. Material : TANTALUM
Gamma Ray Energy: 510.75 510.96 KeV
Gamma Ray Energy: 697.30 697.15 KeV
SLOPE: 1.001917 INTERCEPT: -1.185669

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
138.385	32.780	12	0.263	0.0209	0.002726	96.59175	117.	432.06	CO57 *
157.880	23.643	50	0.119	0.1038	0.012475	9.51565	0.505E+05	58.37	56NI
180.968	16.902	133	1.560	0.1861	0.020377	76.55064	82.6	24.05	HF/LU
271.332	6.415	286	3.626	0.4269	0.033967	106.75963	119.	17.15	LU173
342.922	3.968	168	0.453	0.5641	0.036256	12.49356	26.4	14.53	HF175
390.181	3.142	12	0.044	0.6256	0.035466	1.24013	1.95	169.49	SN113*
697.300	1.469	34	1.169	0.7820	0.024226	48.27121	52.1	114.30	HF/LU*
810.203	1.275	109	0.257	0.8035	0.021247	12.09450	25.3	17.55	CO58
847.402	1.226	8	0.019	0.8092	0.020418	0.92000	1.80	291.50	CO56 *
901.426	1.163	151	1.230	0.8166	0.019327	63.63611	68.7	12.73	HF/LU
912.828	1.151	105	1.664	0.8180	0.019112	87.07598	94.0	18.08	HF/LU*
1094.694	1.001	290	1.071	0.8359	0.016281	65.79821	71.0	8.80	HF/LU*
1121.736	0.984	6	0.040	0.8380	0.015940	2.52553	3.99	230.07	TA182*
1222.811	0.928	47	0.408	0.8449	0.014811	27.57000	43.6	26.21	TA182
1333.959	0.876	25	0.059	0.8513	0.013788	4.25381	4.37	73.59	CO60 *

LDEF RUN NO. 62
Energy Calibration: Calibration Spectrum
Spectrum Name: TAC31.PCA Acquisition Time: 0.98 Days
Sample Mass: 0.136000 Kilograms. Material : TANTALUM
Gamma Ray Energy: 55.80 56.09 KeV
Gamma Ray Energy: 1221.41 1221.95 KeV
SLOPE: 0.999782 INTERCEPT: -0.277779

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
139.052	32.385	37	0.812	0.0231	0.003001	270.53675	328.	234.91	CO57 *
181.043	16.884	144	1.689	0.1863	0.020388	82.83954	89.4	53.80	HF/LU
271.613	6.400	238	3.018	0.4276	0.033973	88.82720	98.6	34.13	LU173
343.127	3.964	146	0.394	0.5644	0.036236	10.86333	22.9	38.19	HF175
810.585	1.275	100	0.236	0.8036	0.021224	11.10785	23.2	35.50	CO58
846.858	1.226	21	0.049	0.8092	0.020416	2.41523	4.74	153.17	CO56 *
900.876	1.163	94	0.766	0.8165	0.019324	39.62046	42.8	33.51	HF/LU
911.713	1.152	92	1.458	0.8178	0.019119	76.26686	82.3	45.69	HF/LU*
1093.614	1.002	314	1.160	0.8358	0.016283	71.23320	76.9	12.63	HF/LU
1120.768	0.985	5	0.012	0.8379	0.015941	0.73585	1.37	694.85	SC46 *
1172.447	0.954	-15	-0.035	0.8416	0.015335	-2.29670	0.000E+00	188.32	CO60 *
1221.406	0.929	64	0.433	0.8448	0.014813	29.20580	46.1	39.51	TA182
1236.943	0.921	37	0.130	0.8457	0.014658	8.83751	17.3	83.06	CO56 *
1332.612	0.877	22	0.052	0.8512	0.013789	3.74325	3.85	144.52	CO60 *

LDEF RUN NO. 62
Energy Calibration: Calibration Spectrum
Spectrum Name: TAC31.PCA Acquisition Time: 0.98 Days
Sample Mass: 0.136000 Kilograms. Material : TANTALUM
Gamma Ray Energy: 55.80 56.09 KeV
Gamma Ray Energy: 1221.41 1221.95 KeV
SLOPE: 0.999782 INTERCEPT: -0.277779

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
139.052	32.385	141	3.094	0.0231	0.003001	1030.96434	0.125E+04	52.81	CO57
181.043	16.884	144	1.689	0.1863	0.020388	82.83954	89.4	53.80	HF/LU
271.613	6.400	238	3.018	0.4276	0.033973	88.82720	98.6	34.13	LU173
343.127	3.964	146	0.394	0.5644	0.036236	10.86333	22.9	38.19	HF175
810.585	1.275	100	0.236	0.8036	0.021224	11.10785	23.2	35.50	CO58
846.858	1.226	55	0.129	0.8092	0.020416	6.32560	12.4	56.67	CO56
900.876	1.163	94	0.766	0.8165	0.019324	39.62046	42.8	33.51	HF/LU
911.713	1.152	153	2.425	0.8178	0.019119	126.83511	137.	24.90	HF/LU
1093.614	1.002	314	1.160	0.8358	0.016283	71.23320	76.9	12.63	HF/LU
1120.768	0.985	54	0.127	0.8379	0.015941	7.94718	14.8	57.72	SC46
1172.447	0.954	44	0.103	0.8416	0.015335	6.73698	6.92	61.65	CO60
1221.406	0.929	64	0.433	0.8448	0.014813	29.20580	46.1	39.51	TA182
1236.943	0.921	58	0.203	0.8457	0.014658	13.85340	27.2	52.06	CO56
1332.612	0.877	82	0.192	0.8512	0.013789	13.95210	14.3	34.66	CO60

LDEF RUN NO. 63
Energy Calibration: Calibration Spectrum
Spectrum Name: TAC32.PCA Acquisition Time: 1.92 Days
Sample Mass: 0.136000 Kilograms. Material : TANTALUM
Gamma Ray Energy: 181.56 181.42 KeV
Gamma Ray Energy: 1221.41 1222.02 KeV
SLOPE: 0.999276 INTERCEPT: 0.271439

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
181.560	16.766	188	1.124	0.1879	0.020516	54.76620	59.2	34.12	HF/LU
272.124	6.374	589	3.806	0.4288	0.034012	111.88796	124.	20.73	LU173
343.553	3.954	341	0.469	0.5651	0.036235	12.92968	27.4	23.44	HF175
694.728	1.474	190	3.330	0.7814	0.024287	137.11332	148.	31.61	HF/LU
810.024	1.276	136	0.163	0.8035	0.021237	7.69319	16.2	40.87	CO58
846.558	1.227	107	0.128	0.8091	0.020422	6.26899	12.3	46.18	CO56
900.838	1.163	314	1.303	0.8165	0.019324	67.43817	72.8	17.29	HF/LU
911.990	1.151	264	2.132	0.8179	0.019114	111.54880	120.	16.63	HF/LU
1093.769	1.002	581	1.094	0.8358	0.016281	67.17262	72.6	10.88	HF/LU
1120.759	0.985	129	0.154	0.8379	0.015941	9.67418	18.1	33.85	SC46
1173.161	0.954	75	0.090	0.8416	0.015327	5.85476	6.02	43.08	CO60
1189.609	0.945	61	0.442	0.8427	0.015147	29.17412	46.2	46.28	TA182
1221.406	0.929	89	0.307	0.8448	0.014813	20.69582	32.8	41.99	TA182
1237.654	0.921	54	0.096	0.8458	0.014650	6.57574	12.9	50.35	CO56
1332.346	0.877	123	0.147	0.8512	0.013791	10.66249	11.0	28.27	CO60

LDEF RUN NO. 63
Energy Calibration: Calibration Spectrum
Spectrum Name: TAC32.PCA Acquisition Time: 1.92 Days
Sample Mass: 0.136000 Kilograms. Material : TANTALUM
Gamma Ray Energy: 181.56 181.42 KeV
Gamma Ray Energy: 1221.41 1222.02 KeV
SLOPE: 0.999276 INTERCEPT: 0.271439

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
181.560	16.766	188	1.124	0.1879	0.020516	54.76620	59.2	34.12	HF/LU
272.124	6.374	589	3.806	0.4288	0.034012	111.88796	124.	20.73	LU173
343.553	3.954	341	0.469	0.5651	0.036235	12.92968	27.4	23.44	HF175
694.728	1.474	-230	-4.031	0.7814	0.024287	-165.97927	0.000E+00	46.59	HF/LU*
810.024	1.276	136	0.163	0.8035	0.021237	7.69319	16.2	40.87	CO58
846.558	1.227	41	0.049	0.8091	0.020422	2.40214	4.73	126.24	CO56 *
900.838	1.163	314	1.303	0.8165	0.019324	67.43817	72.8	17.29	HF/LU
911.990	1.151	144	1.163	0.8179	0.019114	60.84480	65.7	39.16	HF/LU*
1093.769	1.002	581	1.094	0.8358	0.016281	67.17262	72.6	10.88	HF/LU
1120.759	0.985	33	0.039	0.8379	0.015941	2.47479	4.64	160.24	SC46 *
1173.161	0.954	-41	-0.049	0.8416	0.015327	-3.20060	0.000E+00	87.73	CO60 *
1189.609	0.945	61	0.442	0.8427	0.015147	29.17412	46.2	46.28	TA182
1221.406	0.929	89	0.307	0.8448	0.014813	20.69582	32.8	41.99	TA182
1237.654	0.921	12	0.021	0.8458	0.014650	1.46128	2.88	248.37	CO56 *
1332.346	0.877	5	0.006	0.8512	0.013791	0.43343	0.445	900.26	CO60 *

LDEF RUN NO. 63
Energy Calibration: Calibration Spectrum
Spectrum Name: TAC32.sho Acquisition Time: 1.92 Days
Sample Mass: 0.136000 Kilograms. Material : TANTALUM
Gamma Ray Energy: 510.25 510.85 KeV
Gamma Ray Energy: 1173.28 1173.25 KeV
SLOPE: 1.000950 INTERCEPT: -1.085114

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
138.557	32.677	23	0.257	0.0214	0.002796	91.97474	112.	406.33	CO57 *
157.607	23.743	109	0.132	0.1027	0.012349	10.67851	0.597E+05	41.80	56NI
180.641	16.977	232	1.387	0.1851	0.020295	68.31889	73.8	19.87	HF/LU
271.101	6.427	601	3.883	0.4264	0.033949	114.37968	127.	14.27	LU173
322.061	4.481	69	0.839	0.5303	0.036155	23.20648	155.	49.63	CR51
342.698	3.973	392	0.539	0.5638	0.036256	14.85457	31.5	12.43	HF175
696.905	1.470	-21	-0.368	0.7819	0.024237	-15.18563	0.000E+00	344.59	HF/LU*
809.624	1.276	202	0.243	0.8034	0.021260	11.41402	24.0	14.63	CO58
846.336	1.227	16	0.019	0.8091	0.020441	0.93656	1.84	233.11	CO56 *
900.648	1.164	320	1.328	0.8165	0.019341	68.66671	74.2	9.81	HF/LU
911.966	1.152	201	1.623	0.8179	0.019128	84.86958	91.7	14.49	HF/LU*
1093.772	1.002	579	1.090	0.8358	0.016293	66.89210	72.3	7.55	HF/LU
1121.292	0.984	29	0.099	0.8379	0.015946	6.21799	9.85	77.57	TA182*
1173.275	0.954	-17	-0.020	0.8416	0.015337	-1.32619	0.000E+00	127.52	CO60 *
1188.448	0.946	37	0.273	0.8427	0.015171	17.99483	28.5	38.30	TA182
1221.872	0.928	93	0.412	0.8448	0.014820	27.78053	44.0	18.20	TA182
1237.777	0.920	3	0.005	0.8458	0.014661	0.36507	0.719	605.66	CO56 *
1332.859	0.877	12	0.014	0.8512	0.013797	1.03977	1.07	246.61	CO60 *

LDEF RUN NO. 64
Energy Calibration: Calibration Spectrum
Spectrum Name: NIC31.PCA Acquisition Time: 2.03 Days
Sample Mass: 0.076800 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.17 KeV
Gamma Ray Energy: 1173.24 1172.99 KeV
SLOPE: 1.000339 INTERCEPT: -0.150406

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	14387	33.786	0.6189	0.086988	388.40111	475.	6.17	CO57
136.496	2.301	1972	37.039	0.6649	0.087502	423.29504	517.	10.34	CO57
811.255	0.603	293	0.591	0.8706	0.022974	25.73640	55.5	17.42	CO58
835.443	0.594	687	1.380	0.8718	0.022310	61.84325	73.7	11.30	MN54
847.767	0.590	313	0.629	0.8724	0.021988	28.61081	57.7	17.65	CO56 *
889.441	0.576	56	0.112	0.8744	0.020967	5.36358	10.3	55.68	SC46
1120.859	0.513	70	0.141	0.8831	0.016799	8.36768	16.0	77.08	SC46 *
1173.237	0.502	97	0.195	0.8847	0.016111	12.10061	12.4	45.28	CO60 *
1238.359	0.488	148	0.444	0.8867	0.015351	28.89284	58.3	31.03	CO56 *
1332.951	0.471	71	0.143	0.8893	0.014402	9.90035	10.2	72.85	CO60 *

LDEF RUN NO. 64
Energy Calibration: Calibration Spectrum
Spectrum Name: NIC31.PCA Acquisition Time: 2.03 Days
Sample Mass: 0.076800 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.17 KeV
Gamma Ray Energy: 1173.24 1172.99 KeV
SLOPE: 1.000339 INTERCEPT: -0.150406

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	14387	33.786	0.6202	0.087170	387.58820	474.	6.17	CO57
136.496	2.301	1972	37.039	0.6665	0.087712	422.28591	516.	10.34	CO57
811.255	0.603	293	0.591	0.8716	0.023000	25.70688	55.5	17.42	CO58
835.443	0.594	687	1.380	0.8728	0.022336	61.77240	73.6	11.30	MN54
847.767	0.590	383	0.770	0.8734	0.022013	34.96933	70.6	14.11	CO56
889.441	0.576	56	0.112	0.8754	0.020991	5.35748	10.3	55.68	SC46
1120.859	0.513	171	0.343	0.8841	0.016818	20.41819	39.1	25.84	SC46
1173.237	0.502	220	0.442	0.8857	0.016130	27.41377	28.2	19.13	CO60
1238.359	0.488	193	0.578	0.8877	0.015368	37.63471	75.9	23.06	CO56
1332.951	0.471	196	0.394	0.8903	0.014419	27.29834	28.1	21.75	CO60

LDEF RUN NO. 89
Energy Calibration: Calibration Spectrum
Spectrum Name: NIC32.PCA Acquisition Time: 3.34 Days
Sample Mass: 0.076800 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.29 KeV
Gamma Ray Energy: 1173.24 1173.57 KeV
SLOPE: 0.999901 INTERCEPT: -0.216919

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	19671	28.035	0.6189	0.086988	322.28652	453.	6.09	CO57
136.200	2.309	3019	34.413	0.6641	0.087508	393.25803	553.	10.19	CO57
810.723	0.603	304	0.372	0.8706	0.022989	16.19452	59.7	23.14	CO58
834.811	0.594	831	1.013	0.8718	0.022327	45.36504	61.0	11.42	MN54
847.259	0.590	445	0.543	0.8724	0.022000	24.67203	81.2	17.46	CO56 *
889.405	0.576	64	0.078	0.8744	0.020968	3.71990	11.2	39.55	SC46
1120.942	0.513	-88	-0.107	0.8831	0.016798	-6.38450	0.000E+00	84.94	SC46 *
1173.237	0.502	199	0.243	0.8847	0.016111	15.06587	15.8	34.33	CO60 *
1237.811	0.489	138	0.251	0.8867	0.015357	16.34332	53.8	39.43	CO56 *
1332.481	0.471	83	0.101	0.8893	0.014406	7.02182	7.37	87.53	CO60 *

* INDICATES BACKGROUND SUBTRACTED USING NOBKG.dat

LDEF RUN NO. 112
Energy Calibration: Calibration Spectrum
Spectrum Name: NIG121.DAT Acquisition Time: 3.05 Days
Sample Mass: 0.076500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.16 KeV
Gamma Ray Energy: 1173.24 1173.63 KeV
SLOPE: 0.999720 INTERCEPT: -0.064857

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	11801	18.505	0.6202	0.121662	152.09984	215.	6.29	CO57
136.457	2.302	1798	22.550	0.6664	0.123394	182.74713	259.	13.55	CO57
811.048	0.603	334	0.450	0.8716	0.033285	13.52084	51.3	17.23	CO58
834.662	0.594	452	0.606	0.8728	0.032357	18.73332	25.4	14.54	MN54
847.278	0.590	335	0.450	0.8734	0.031882	14.10135	47.7	24.91	CO56
1120.272	0.514	123	0.165	0.8841	0.024365	6.76908	20.9	36.26	SC46
1173.237	0.502	278	0.373	0.8857	0.023343	15.98307	16.8	22.38	CO60
1237.749	0.489	132	0.264	0.8877	0.022229	11.88256	40.2	30.89	CO56
1332.463	0.471	203	0.272	0.8903	0.020812	13.07927	13.7	22.95	CO60

LDEF RUN NO. 113
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF21.PCA Acquisition Time: 0.95 Days
Sample Mass: 0.073000 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.07 KeV
Gamma Ray Energy: 1173.24 1173.63 KeV
SLOPE: 0.999635 INTERCEPT: 0.035576

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	3442	18.089	0.6362	0.124802	144.94104	206.	6.91	CO57
136.346	2.305	400	16.813	0.6805	0.126070	133.36407	190.	25.94	CO57
810.719	0.603	107	0.483	0.8786	0.033566	14.39553	55.7	30.49	CO58
835.140	0.594	159	0.715	0.8798	0.032597	21.92296	29.8	20.99	MN54
846.966	0.590	112	0.504	0.8804	0.032148	15.66978	53.9	35.33	CO56
1173.237	0.502	79	0.355	0.8927	0.023527	15.10290	15.9	33.44	CO60
1238.413	0.488	81	0.543	0.8947	0.022393	24.25888	83.4	39.96	CO56
1332.339	0.471	70	0.315	0.8972	0.020976	14.99785	15.8	34.80	CO60
2599.806	0.338	18	0.484	0.9165	0.012918	37.49095	129.	50.36	CO56

LDEF RUN NO. 114
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF22.PCA Acquisition Time: 3.33 Days
Sample Mass: 0.073000 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.09 KeV
Gamma Ray Energy: 1173.24 1173.66 KeV
SLOPE: 0.999625 INTERCEPT: 0.016754

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	11991	18.029	0.6362	0.124802	144.46065	207.	6.26	CO57
136.366	2.304	1705	20.504	0.6806	0.126070	162.63649	233.	14.57	CO57
810.603	0.603	194	0.251	0.8786	0.033571	7.46620	29.8	28.47	CO58
835.174	0.594	649	0.835	0.8798	0.032596	25.60218	35.1	11.65	MN54
846.799	0.590	346	0.445	0.8804	0.032155	13.84665	49.0	21.38	CO56
1119.847	0.514	153	0.197	0.8910	0.024567	8.00723	25.8	34.50	SC46
1173.237	0.502	312	0.401	0.8927	0.023527	17.06481	18.0	18.91	CO60
1238.113	0.488	249	0.478	0.8947	0.022398	21.33062	75.5	24.44	CO56
1331.877	0.471	279	0.359	0.8972	0.020982	17.09695	18.0	18.20	CO60

* INDICATES BACKGROUND SUBTRACTED USING BG172INC

LDEF RUN NO. 112
Energy Calibration: Calibration Spectrum
Spectrum Name: NIG121.DAT Acquisition Time: 3.05 Days
Sample Mass: 0.076500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.16 KeV
Gamma Ray Energy: 1173.24 1173.63 KeV
SLOPE: 0.999720 INTERCEPT: -0.064857

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	11801	18.505	0.6550	0.116364	159.02513	225.	6.29	CO57
136.457	2.302	1798	22.550	0.6982	0.115968	194.44929	275.	13.55	CO57
811.048	0.603	334	0.450	0.8866	0.031084	14.47818	55.0	17.23	CO58
834.662	0.594	452	0.606	0.8877	0.030226	20.05384	27.2	14.54	MN54
847.278	0.590	230	0.309	0.8883	0.029787	10.36261	35.0	37.50	CO56 *
911.920	0.569	-91	-0.824	0.8910	0.027729	-29.72866	0.000E+00	98.28	HF/LU*
1120.272	0.514	-29	-0.039	0.8982	0.022754	-1.70895	0.000E+00	226.24	SC46 *
1173.237	0.502	93	0.125	0.8998	0.021784	5.72949	6.02	70.51	CO60 *
1237.749	0.489	65	0.130	0.9015	0.020722	6.27683	21.2	69.13	CO56 *
1332.463	0.471	15	0.020	0.9038	0.019363	1.03881	1.09	433.86	CO60 *

LDEF RUN NO. 113
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF21.PCA Acquisition Time: 0.95 Days
Sample Mass: 0.073000 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.07 KeV
Gamma Ray Energy: 1173.24 1173.63 KeV
SLOPE: 0.999635 INTERCEPT: 0.035576

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	3442	18.089	0.6550	0.116364	155.45176	221.	6.91	CO57
136.346	2.305	400	16.813	0.6979	0.115978	144.96958	206.	25.94	CO57
810.719	0.603	107	0.483	0.8866	0.031096	15.53884	60.1	30.49	CO58
835.140	0.594	159	0.715	0.8878	0.030209	23.65589	32.2	20.99	MN54
846.966	0.590	79	0.355	0.8883	0.029797	11.92486	41.0	50.81	CO56 *
1173.237	0.502	22	0.099	0.8998	0.021784	4.54248	4.77	123.76	CO60 *
1238.413	0.488	60	0.402	0.9015	0.020711	19.42838	66.8	54.69	CO56 *
1332.339	0.471	12	0.054	0.9038	0.019364	2.78500	2.93	233.76	CO60 *
2599.806	0.338	18	0.484	0.9217	0.011412	42.43879	146.	50.36	CO56

LDEF RUN NO. 114
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF22.PCA Acquisition Time: 3.33 Days
Sample Mass: 0.073000 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.09 KeV
Gamma Ray Energy: 1173.24 1173.66 KeV
SLOPE: 0.999625 INTERCEPT: 0.016754

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	11991	18.029	0.6550	0.116364	154.93653	222.	6.26	CO57
136.366	2.304	1705	20.504	0.6979	0.115976	176.79139	254.	14.57	CO57
810.603	0.603	194	0.251	0.8866	0.031101	8.05910	32.2	28.47	CO58
835.174	0.594	649	0.835	0.8878	0.030208	27.62611	37.8	11.65	MN54
846.799	0.590	231	0.297	0.8883	0.029803	9.97388	35.3	33.70	CO56 *
911.475	0.569	-123	-1.068	0.8910	0.027742	-38.51069	0.000E+00	66.95	HF/LU*
1119.847	0.514	-13	-0.017	0.8982	0.022762	-0.73430	0.000E+00	571.87	SC46 *
1173.237	0.502	110	0.142	0.8998	0.021784	6.49796	6.84	57.34	CO60 *
1238.113	0.488	175	0.336	0.9015	0.020716	16.20838	57.4	36.51	CO56 *
1331.877	0.471	74	0.095	0.9038	0.019370	4.91195	5.17	95.06	CO60 *

* INDICATES BACKGROUND SUBTRACTED USING BG172INC

LDEF RUN NO. 112
Energy Calibration: Calibration Spectrum
Spectrum Name: NIG121.SHO Acquisition Time: 3.05 Days
Sample Mass: 0.076500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.65 KeV
Gamma Ray Energy: 1173.24 1172.12 KeV
SLOPE: 1.002581 INTERCEPT: -1.908142

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.059	2.786	11126	17.446	0.6550	0.116363	149.93000	212.	7.25	CO57
137.451	2.274	1232	15.451	0.7007	0.115870	133.34971	189.	12.06	CO57
389.477	0.865	-73	-0.153	0.8528	0.062114	-2.46200	0.000E+00	33.53	SN113*
694.668	0.650	-577	-11.343	0.8805	0.036155	-313.73289	0.000E+00	25.51	HF/LU*
810.984	0.603	408	0.550	0.8866	0.031087	17.68453	67.2	9.96	CO58
835.347	0.594	575	0.771	0.8878	0.030202	25.53149	34.6	8.95	MN54
847.351	0.590	236	0.317	0.8883	0.029784	10.63383	35.9	19.48	CO56 *
911.487	0.569	-122	-1.105	0.8910	0.027742	-39.83747	0.000E+00	53.69	HF/LU*
1120.141	0.514	-35	-0.047	0.8982	0.022756	-2.06229	0.000E+00	148.30	SC46 *
1173.237	0.502	69	0.093	0.8998	0.021784	4.25091	4.47	51.52	CO60 *
1238.224	0.488	85	0.170	0.9015	0.020714	8.21112	27.8	34.72	CO56 *
1332.166	0.471	18	0.024	0.9038	0.019367	1.24632	1.31	293.24	CO60 *

LDEF RUN NO. 113
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF21.SHO Acquisition Time: 0.95 Days
Sample Mass: 0.076500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.01 KeV
Gamma Ray Energy: 1173.24 1173.63 KeV
SLOPE: 0.999576 INTERCEPT: 0.100746

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
119.399	2.896	605	3.034	0.6457	0.116200	26.11031	37.2	14.80	CO57
122.061	2.786	2933	14.709	0.6550	0.116364	126.40326	180.	7.53	CO57
136.242	2.308	420	16.846	0.6976	0.115988	145.24125	207.	19.50	CO57
660.714	0.666	55	0.249	0.8784	0.037958	6.56745	9.64	31.47	AG110
694.784	0.650	-162	-10.185	0.8805	0.036149	-281.75367	0.000E+00	31.10	HF/LU*
811.120	0.603	91	0.392	0.8866	0.031082	12.61664	48.8	16.49	CO58
835.345	0.594	148	0.635	0.8878	0.030202	21.01697	28.6	12.93	MN54
847.404	0.590	51	0.219	0.8883	0.029783	7.34975	25.3	35.80	CO56 *
913.824	0.568	-28	-0.811	0.8911	0.027673	-29.31357	0.000E+00	83.26	HF/LU*
1096.552	0.519	3	0.020	0.8975	0.023221	0.87237	1.00	367.24	HF/LU*
1118.566	0.514	-14	-0.060	0.8982	0.022787	-2.63470	0.000E+00	137.56	SC46 *
1173.237	0.502	31	0.133	0.8998	0.021784	6.10792	6.42	60.87	CO60 *
1187.187	0.499	22	0.582	0.9001	0.021544	27.02832	62.5	54.87	TA182
1238.453	0.488	10	0.064	0.9015	0.020711	3.09002	10.6	135.66	CO56 *
1332.541	0.471	21	0.090	0.9039	0.019362	4.65142	4.89	102.99	CO60 *

LDEF RUN NO. 114
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF22.SHO Acquisition Time: 3.33 Days
Sample Mass: 0.076500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 121.97 KeV
Gamma Ray Energy: 1173.24 1173.72 KeV
SLOPE: 0.999454 INTERCEPT: 0.160553

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
119.594	2.888	2041	2.928	0.6464	0.116215	25.19760	36.2	14.50	CO57
122.061	2.786	10003	14.352	0.6550	0.116364	123.33607	177.	7.28	CO57
136.529	2.300	1478	16.961	0.6983	0.115961	146.26127	210.	17.42	CO57
155.501	1.875	116	0.144	0.7394	0.112998	1.27460	0.124E+08	175.18	56NI
179.113	1.553	128	0.785	0.7729	0.107259	7.31965	8.45	47.25	HF/LU
810.834	0.603	296	0.365	0.8866	0.031092	11.73704	46.9	14.45	CO58
834.867	0.594	664	0.815	0.8877	0.030219	26.96160	36.9	11.45	MN54
846.830	0.590	271	0.333	0.8883	0.029802	11.16605	39.5	18.30	CO56 *
911.800	0.569	-114	-0.945	0.8910	0.027733	-34.07155	0.000E+00	61.41	HF/LU*
1120.136	0.514	-51	-0.063	0.8982	0.022756	-2.74959	0.000E+00	111.45	SC46 *
1173.237	0.502	116	0.142	0.8998	0.021784	6.53888	6.88	34.23	CO60 *
1238.374	0.488	105	0.192	0.9015	0.020712	9.28193	32.8	31.03	CO56 *
1332.172	0.471	37	0.045	0.9038	0.019367	2.34408	2.47	149.81	CO60 *

LDEF RUN NO. 115
Energy Calibration: Calibration Spectrum
Spectrum Name: NIF23.SHO Acquisition Time: 3.33 Days
Sample Mass: 0.076500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 122.00 KeV
Gamma Ray Energy: 1173.24 1174.09 KeV
SLOPE: 0.999129 INTERCEPT: 0.169312

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
119.551	2.890	2011	2.885	0.6462	0.116212	24.82790	36.1	15.55	CO57
122.061	2.786	10436	14.973	0.6550	0.116364	128.67491	187.	7.24	CO57
136.599	2.298	1662	19.072	0.6985	0.115954	164.47933	239.	15.56	CO57
158.564	1.822	0	0.000	0.7447	0.112347	0.00000	0.000E+00	8.02	56NI
810.695	0.603	238	0.293	0.8866	0.031097	9.43572	39.4	12.43	CO58
835.375	0.594	631	0.774	0.8878	0.030201	25.63706	35.5	7.81	MN54
847.025	0.590	274	0.336	0.8883	0.029795	11.29222	41.7	16.06	CO56 *
899.148	0.573	46	0.196	0.8905	0.028112	6.96978	8.09	41.73	HF/LU
1039.593	0.533	40	0.348	0.8957	0.024434	14.24263	52.6	47.88	CO56
1119.933	0.514	-64	-0.079	0.8982	0.022760	-3.44985	0.000E+00	90.03	SC46 *
1173.237	0.502	85	0.104	0.8998	0.021784	4.79142	5.05	48.02	CO60 *
1238.644	0.488	69	0.126	0.9015	0.020708	6.10079	22.5	46.71	CO56 *
1332.498	0.471	60	0.074	0.9038	0.019362	3.80208	4.01	94.51	CO60 *
2597.755	0.338	40	0.294	0.9217	0.011418	25.73417	95.0	33.05	CO56

* INDICATES BACKGROUND SUBTRACTED USING BG172inc

LDEF RUN NO. 122
Energy Calibration: Calibration Spectrum
Spectrum Name: H12NIU.PCA Acquisition Time: 1.16 Days
Sample Mass: 0.055500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.58 KeV
Gamma Ray Energy: 1332.51 1332.32 KeV
SLOPE: 1.001414 INTERCEPT: -1.693726

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	4388	24.977	0.6218	0.121971	204.78128	335.	6.83	CO57
136.261	2.307	602	27.407	0.6650	0.123233	222.40083	363.	22.56	CO57
834.036	0.595	165	0.803	0.8618	0.031972	25.12273	38.5	25.55	MN54
846.133	0.590	36	0.175	0.8623	0.031522	5.56371	31.0	103.97	CO56 *
1120.961	0.513	-3	-0.015	0.8731	0.024050	-0.60718	0.000E+00	952.61	SC46 *
1172.063	0.502	47	0.229	0.8747	0.023074	9.92306	10.6	77.55	CO60 *
1237.696	0.489	85	0.617	0.8766	0.021953	28.12580	157.	40.27	CO56 *
1275.630	0.481	68	0.331	0.8776	0.021362	15.50159	17.8	38.70	NA22
1332.510	0.471	34	0.166	0.8790	0.020548	8.05422	8.63	105.22	CO60 *

LDEF RUN NO. 122
Energy Calibration: Calibration Spectrum
Spectrum Name: H12NIU.PCA Acquisition Time: 1.16 Days
Sample Mass: 0.055500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.58 KeV
Gamma Ray Energy: 1332.51 1332.32 KeV
SLOPE: 1.001414 INTERCEPT: -1.693726

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	4388	24.977	0.6218	0.121971	204.78128	335.	6.83	CO57
136.261	2.307	602	27.407	0.6650	0.123233	222.40083	363.	22.56	CO57
834.036	0.595	165	0.803	0.8618	0.031972	25.12273	38.5	25.55	MN54
846.133	0.590	76	0.370	0.8623	0.031522	11.74561	65.5	47.75	CO56
1120.961	0.513	54	0.263	0.8731	0.024050	10.92915	53.7	41.17	SC46
1172.063	0.502	117	0.570	0.8747	0.023074	24.70208	26.5	30.49	CO60
1237.696	0.489	110	0.799	0.8766	0.021953	36.39809	203.	30.60	CO56
1275.630	0.481	68	0.331	0.8776	0.021362	15.50159	17.8	38.70	NA22
1332.510	0.471	105	0.511	0.8790	0.020548	24.87334	26.7	30.11	CO60

LDEF RUN NO. 124
Energy Calibration: Calibration Spectrum
Spectrum Name: H12NI2.PCA Acquisition Time: 1.90 Days
Sample Mass: 0.055500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.87 KeV
Gamma Ray Energy: 1332.51 1332.68 KeV
SLOPE: 1.001356 INTERCEPT: -1.976944

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	7251	25.161	0.6218	0.121971	206.28372	340.	6.69	CO57
136.180	2.309	1131	31.389	0.6648	0.123233	254.70968	420.	13.49	CO57
834.075	0.595	258	0.766	0.8618	0.031971	23.94781	37.0	22.13	MN54
845.711	0.590	58	0.172	0.8623	0.031538	5.46162	31.4	81.24	CO56 *
1119.001	0.514	17	0.050	0.8731	0.024089	2.09402	10.6	285.13	SC46 *
1173.234	0.502	51	0.151	0.8747	0.023053	6.56994	7.05	121.97	CO60 *
1237.411	0.489	44	0.195	0.8766	0.021957	8.87346	51.0	93.35	CO56 *
1277.385	0.481	80	0.237	0.8776	0.021336	11.13114	12.8	59.05	NA22
1332.510	0.471	61	0.181	0.8790	0.020548	8.80883	9.45	84.12	CO60 *

LDEF RUN NO. 124
Energy Calibration: Calibration Spectrum
Spectrum Name: H12NI2.PCA Acquisition Time: 1.90 Days
Sample Mass: 0.055500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.87 KeV
Gamma Ray Energy: 1332.51 1332.68 KeV
SLOPE: 1.001356 INTERCEPT: -1.976944

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	7251	25.161	0.6218	0.121971	206.28372	340.	6.69	CO57
136.180	2.309	1131	31.389	0.6648	0.123233	254.70968	420.	13.49	CO57
834.075	0.595	258	0.766	0.8618	0.031971	23.94781	37.0	22.13	MN54
845.711	0.590	124	0.368	0.8623	0.031538	11.67657	67.1	35.99	CO56
1119.001	0.514	111	0.329	0.8731	0.024089	13.67272	69.1	34.74	SC46
1173.234	0.502	166	0.493	0.8747	0.023053	21.38451	22.9	36.63	CO60
1237.411	0.489	86	0.381	0.8766	0.021957	17.34359	99.6	45.75	CO56
1277.385	0.481	80	0.237	0.8776	0.021336	11.13114	12.8	59.05	NA22
1332.510	0.471	178	0.528	0.8790	0.020548	25.70445	27.6	24.34	CO60

LDEF RUN NO. 136
Energy Calibration: Calibration Spectrum
Spectrum Name: H12NI3.PCA Acquisition Time: 0.89 Days
Sample Mass: 0.055500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.82 KeV
Gamma Ray Energy: 1173.24 1172.21 KeV
SLOPE: 1.002657 INTERCEPT: -2.088043

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	2885	21.263	0.6218	0.121971	174.32625	288.	7.25	CO57
135.276	2.335	574	33.835	0.6623	0.123228	274.57705	454.	20.39	CO57
835.071	0.594	104	0.656	0.8618	0.031933	20.52761	31.8	33.22	MN54
1119.194	0.514	-2	-0.013	0.8731	0.024085	-0.52333	0.000E+00	1567.11	SC46 *
1173.237	0.502	57	0.360	0.8747	0.023053	15.59621	16.7	52.92	CO60 *
1235.823	0.489	69	0.649	0.8765	0.021982	29.52133	172.	42.46	CO56
1332.730	0.471	59	0.372	0.8790	0.020545	18.09890	19.4	65.59	CO60 *
1768.996	0.408	31	1.260	0.8876	0.016256	77.52856	451.	55.17	CO56

LDEF RUN NO. 136
Energy Calibration: Calibration Spectrum
Spectrum Name: H12NI3.PCA Acquisition Time: 0.89 Days
Sample Mass: 0.055500 Kilograms. Material : NICKEL
Gamma Ray Energy: 122.06 123.82 KeV
Gamma Ray Energy: 1173.24 1172.21 KeV
SLOPE: 1.002657 INTERCEPT: -2.088043

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
122.061	2.786	2885	21.263	0.6218	0.121971	174.32625	288.	7.25	CO57
135.276	2.335	574	33.835	0.6623	0.123228	274.57705	454.	20.39	CO57
835.071	0.594	104	0.656	0.8618	0.031933	20.52761	31.8	33.22	MN54
1119.194	0.514	42	0.265	0.8731	0.024085	10.98996	56.2	66.93	SC46
1173.237	0.502	111	0.700	0.8747	0.023053	30.37157	32.6	26.80	CO60
1235.823	0.489	69	0.649	0.8765	0.021982	29.52133	172.	42.46	CO56
1332.730	0.471	114	0.718	0.8790	0.020545	34.97075	37.5	32.13	CO60
1768.996	0.408	31	1.260	0.8876	0.016256	77.52856	451.	55.17	CO56

Appendix D

Results of the Analysis of Aluminum Material

This appendix contains the results of the analysis of the gamma-ray spectra taken of samples of the aluminum material taken from LDEF. The heading of each table gives pertinent information about the run, or spectrum, number including the spectrum name, the mass of the sample, the acquisition time and the correction to the energy calibration taken from the MSFC spectra and the MSFC data book. The column header gives the gamma-ray energy, the peak area, the efficiency (EFFATN) correction, the corrected efficiency, the activated in pCi/kg (PC/Kg) and that specific activity corrected to January 20, 1990, the propagated error, and the identity of the radioisotope. The error contains the statistical error in the peak area including the error in the background subtraction, the error in the calibration source, and the estimated error in the EFFATN correction. As indicated the asterisk (*) indicates the source of the background subtracted. Before run 172 the subtracted background comes from that spectrum. After run 175 the background comes from run 175. Some spectra were analyzed with no background subtraction and in some cases the spectra were analyzed with several of the peak analysis programs. These latter can be used to judge the effects of the different analyses.

Efficiency calculation done with Runs 146--CPCAL1

* INDICATES BACKGROUND SUBTRACTED USING bg172inc

LDEF RUN NO. 24
Energy Calibration: Calibration Spectrum
Spectrum Name: CPCO97.PCA Acquisition Time: 0.62 Days
Sample Mass: 0.106500 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 477.61 477.84 KeV
Gamma Ray Energy: 1274.53 1274.81 KeV
SLOPE: 0.999942 INTERCEPT: -0.206421

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
477.606	0.231	326	14.783	0.8601	0.068815	214.82054	435.	14.47	BE7
1173.706	0.153	9	0.042	0.8772	0.030819	1.37724	1.40	197.57	CO60 *
1274.530	0.147	207	0.976	0.8786	0.028753	33.94029	35.3	13.46	NA22
1332.677	0.143	-11	-0.052	0.8793	0.027714	-1.87039	0.000E+00	169.27	CO60 *

LDEF RUN NO. 25
Energy Calibration: Calibration Spectrum
Spectrum Name: CPCO37.PCA Acquisition Time: 0.82 Days
Sample Mass: 0.106500 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 1063.10 1062.84 KeV
Gamma Ray Energy: 1274.53 1274.39 KeV
SLOPE: 0.999433 INTERCEPT: 0.862793

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1274.530	0.147	324	1.164	0.8786	0.028753	40.47091	42.1	10.74	NA22

LDEF RUN NO. 68
Energy Calibration: Calibration Spectrum
Spectrum Name: cld25d Acquisition Time: 3.00 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 511.00 511.00 KeV
Gamma Ray Energy: 1237.00 1237.00 KeV
SLOPE: 1.000000 INTERCEPT: 0.000000

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1274.000	0.147	1279	1.711	0.8786	0.028763	59.48040	63.3	7.81	NA22

LDEF RUN NO. 72
Energy Calibration: Calibration Spectrum
Spectrum Name: CLD252.PCA Acquisition Time: 0.81 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 1063.10 1063.91 KeV
Gamma Ray Energy: 1274.53 1275.16 KeV
SLOPE: 1.000852 INTERCEPT: -1.716919

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1172.683	0.153	7	0.035	0.8772	0.030842	1.12639	1.17	302.08	CO60 *
1274.530	0.147	348	1.726	0.8786	0.028753	60.04456	64.3	10.71	NA22
1332.499	0.143	-1	-0.005	0.8793	0.027717	-0.17891	0.000E+00	2517.93	CO60 *

LDEF RUN NO. 79
Energy Calibration: Calibration Spectrum
Spectrum Name: CLD62.PCA Acquisition Time: 0.89 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 569.15 570.46 KeV
Gamma Ray Energy: 1063.10 1063.75 KeV
SLOPE: 1.001338 INTERCEPT: -2.073181

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1274.162	0.147	338	1.532	0.8786	0.028760	53.28424	57.1	11.42	NA22

LDEF RUN NO. 80
Energy Calibration: Calibration Spectrum
Spectrum Name: CLD127.PCA Acquisition Time: 2.73 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 569.15 569.67 KeV
Gamma Ray Energy: 1173.24 1173.08 KeV
SLOPE: 1.001122 INTERCEPT: -1.159180

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
846.391	0.179	2	0.003	0.8715	0.041109	0.07158	0.170	2493.98	CO56 *
1173.237	0.153	9	0.013	0.8772	0.030830	0.42952	0.445	581.89	CO60 *
1274.801	0.147	790	1.162	0.8786	0.028748	40.41774	43.4	9.54	NA22
1332.656	0.143	-39	-0.057	0.8793	0.027714	-2.06884	0.000E+00	141.97	CO60 *

Efficiency calculation done with TVA1 calibration
* INDICATES BACKGROUND SUBTRACTED USING bg172inc

LDEF RUN NO. 24
Energy Calibration: Calibration Spectrum
Spectrum Name: CPCO97.PCA Acquisition Time: 0.62 Days
Sample Mass: 0.106500 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 477.61 477.84 KeV
Gamma Ray Energy: 1274.53 1274.81 KeV
SLOPE: 0.999942 INTERCEPT: -0.206421

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
477.606	0.231	326	14.783	0.7631	0.035224	419.67963	849.	14.47	BE7
1173.706	0.153	9	0.042	0.7776	0.014155	2.99859	3.06	197.57	CO60 *
1274.530	0.147	207	0.976	0.7788	0.013131	74.31930	77.3	13.46	NA22
1332.677	0.143	-11	-0.052	0.7794	0.012624	-4.10601	0.000E+00	169.27	CO60 *

LDEF RUN NO. 25
Energy Calibration: Calibration Spectrum
Spectrum Name: CPCO37.PCA Acquisition Time: 0.82 Days
Sample Mass: 0.106500 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 1063.10 1062.84 KeV
Gamma Ray Energy: 1274.53 1274.39 KeV
SLOPE: 0.999433 INTERCEPT: 0.862793

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1274.530	0.147	324	1.164	0.7788	0.013131	88.61944	92.3	10.74	NA22

LDEF RUN NO. 68
Energy Calibration: Calibration Spectrum
Spectrum Name: cld25d Acquisition Time: 3.00 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 511.00 511.00 KeV
Gamma Ray Energy: 1237.00 1237.00 KeV
SLOPE: 1.000000 INTERCEPT: 0.000000

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1274.000	0.147	1279	1.711	0.7787	0.013136	130.24116	139.	7.81	NA22

LDEF RUN NO. 72
Energy Calibration: Calibration Spectrum
Spectrum Name: CLD252.PCA Acquisition Time: 0.81 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 1063.10 1063.91 KeV
Gamma Ray Energy: 1274.53 1275.16 KeV
SLOPE: 1.000852 INTERCEPT: -1.716919

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1172.683	0.153	7	0.035	0.7776	0.014167	2.45232	2.54	302.08	CO60 *
1274.530	0.147	348	1.726	0.7788	0.013131	131.48001	141.	10.71	NA22
1332.499	0.143	-1	-0.005	0.7794	0.012626	-0.39276	0.000E+00	2517.93	CO60 *

LDEF RUN NO. 79
Energy Calibration: Calibration Spectrum
Spectrum Name: CLD62.PCA Acquisition Time: 0.89 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 569.15 570.46 KeV
Gamma Ray Energy: 1063.10 1063.75 KeV
SLOPE: 1.001338 INTERCEPT: -2.073181

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
1274.162	0.147	338	1.532	0.7788	0.013134	116.67620	125.	11.42	NA22

LDEF RUN NO. 80
Energy Calibration: Calibration Spectrum
Spectrum Name: CLD127.PCA Acquisition Time: 2.73 Days
Sample Mass: 0.078000 Kilograms. Material : ALUMINIUM
Gamma Ray Energy: 569.15 569.67 KeV
Gamma Ray Energy: 1173.24 1173.08 KeV
SLOPE: 1.001122 INTERCEPT: -1.159180

Peak Energy KeV	Mass Absorption coeff	Observed Counts Cts	Observed Activity PC/Kg	Efficiency Attenuation	Corrected Detector Efficiency	Corrected Activity PC/Kg	Activity 1/20/90 PC/Kg	Net Error %	ISOTOPE
846.391	0.179	2	0.003	0.7728	0.019508	0.15084	0.358	2493.98	CO56 *
1173.237	0.153	9	0.013	0.7776	0.014160	0.93517	0.968	581.89	CO60 *
1274.801	0.147	790	1.162	0.7788	0.013129	88.50472	95.0	9.54	NA22
1332.656	0.143	-39	-0.057	0.7794	0.012624	-4.54172	0.000E+00	141.97	CO60 *

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	2/1/96	Final Report: 3/31/94-7/31/95

4. TITLE AND SUBTITLE
Study of Activation of Metal Samples from LDEF-1 and Spacelab-2

5. FUNDING NUMBERS

6. AUTHOR(S)

C. E. Laird

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Department of Physics and Astronomy
Moore 351
Eastern Kentucky University
Richmond, KY 40475

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Gamma-ray spectra obtained from samples flown aboard the Long Duration Exposure Facility (LDEF-1) have been analyzed to obtain the nuclear species produced in this material by the interaction of this material with protons and neutrons encountered in its 69 month orbital flight as well as to quantify the specific activity (pCi/kg) of these nuclear species. Corrections have been made for efficiency, self-attenuation, and background. The results of the spectral analysis have been tabulated and compared to those of other counting laboratories. The spectra from the counting laboratories along with viewing and analysis programs have been submitted to Marshall Space Flight Center for archiving. The form of these data and programs makes it readily accessible to the scientific, engineering and technical communities engaged in space research and application.

14. SUBJECT TERMS

15. NUMBER OF PAGES
147

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
unclassified	unclassified	unclassified	

MAR 24 '95 3:48 FROM NASA DATA INPUT